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ELECTRICAL EFFECTS IN THEATRES.

The services which electricity has rendered to the stage are well illustrated by the article which we print elsewhere, descriptive of the electrical effects used in presenting living pictures. Of all the stage effects ever attempted none has even approached the success that has attended the production of living pictures, and which has resulted from a secure basis of real artistic merit, and not mere theatrical claptrap being involved. While the audience has little evidence of the fact that without electricity the effects necessary to render possible the successful production of the pictures would be impossible of realization, it is nevertheless true, for no other system of illumination would at all admit of the range and flexibility required. The description given in our columns of the various electrical details involved in the production of the pictures is the first that has appeared in print, and will be appreciated by electricians as another illustration of the multifarious uses to which the electric current may be put.

CURRENT AND POTENTIAL.

We print elsewhere an article by Prof. Stine, relating to the question recently raised in our columns between Prof. Waddell and Mr. Pierce, in regard to the generation of a current in a straight wire moving in a magnetic field of varying intensity. Prof. Stine brings out very clearly the principles upon which rests the generation of an E. M. F. on open circuit, and calls attention to an ambiguity in Lenz's law, which has doubtless often been a source of misunderstanding to the student and others. He shows that in considering the generation of current, stress should be laid upon a conductor being closed outside of the coercing magnetic field, or in one of a different strength, and that the fact of closing a circuit does not affect the force but the *amount* of energy transformed. It is also shown that any conductor moved in a magnetic field will absorb energy dependent upon its capacity, and it follows that if a straight conductor is moved in a field of varying intensity, there will be a flow of current in the wire, though negligable in extent—thus far sustaining the position of Prof. Waddell.

SIMULTANEOUS TELEPHONY AND TELEGRAPHY.

The installment in the present issue of our series of popular technical articles, besides giving an intelligent account of long distance telephony, contains a description of the methods of simultaneous telephony and telegraphy. While this subject has been treated at length in several foreign publications, its details have become little known in this country, notwithstanding their interesting character. It will be seen that the principles upon which the system rests are very simple, and consist of the addition of inductance coils and condensers to the telephone circuit. The former allow free passage to the telegraphic instrument of the telegraphic signals, and prevent the rapidly alternating telephonic currents from being shunted away from the telephone, which latter function with respect to the telegraphic current is performed by condensers. Another interesting feature is the use of inductance coils to round off the telegraphic signals so that they will be inaudible in the telephone. This latter object is so thoroughly accomplished that long distance telephone lines can be, and are, used for telegraphic purposes without the telephone subscriber having any indication whatever of the fact.

STATIC ELECTRICITY AND PRINTING.

In another column we print a communication asking a remedy for eliminating the frequent source of trouble and expense encoun-

tered in printing from the presence of static electricity on the sheets. In dry weather this is not only a constant source of serious annoyance in printing, but sometimes renders it difficult to produce satisfactory work. The sheets when printed on one side adhere, thus smearing them when being manipulated for the second impression, and also making it difficult to feed, "to register," while in delivery the sheets are not straightened automatically, thus requiring an attendant at the fly-board. Numerous methods have been proposed to obviate the difficulties referred to, but none, as far as we can learn, has proved practicable. As a practical remedy would be welcomed by the printing trade, and should prove a source of considerable profit, the matter is one well worthy of the attention of electricians. Heretofore inventors seem to have worked on very vague ideas as to the origin of the static charge, and this is the point which should first receive attention. If, as seems probable, the charge is largely generated by the friction which results in separating the sheets in feeding, the question is by no means one easy of solution.

SYMBOLS AND ABBREVIATIONS.

We print elsewhere a reply by our esteemed London contemporary, the *Electrical Review*, to our recent remarks concerning Prof. Jamieson's criticism of the symbols and abbreviations recommended by the Committee on Notation of the Chicago Electrical Congress for international adoption. As will be seen, it consists principally of a narrative of the misfortunes encountered by Prof. Jamieson in his endeavors to bring his own system of symbols before the Congress, and we regret that so much perseverance met with so little success. We will remark, however, that had Prof. Jamieson joined Prof. Macfarlane and others in criticizing the system of Prof. Hospitalier when it was placed before the world in the provisional programme of the American Institute of Electrical Engineers for that purpose, the gentlemen who afterwards became members of the Committee on Notation would have had an opportunity for the preliminary consideration which it was the object of the programme to give. We must reiterate our statement that the system, as far as its main outlines were concerned, had been before the world for some years, and, moreover, from the beginning was put forward for international adoption, which object was advocated at the Frankfort Congress, and led to the table embracing the symbols being printed in the provisional programme. We, perhaps, allowed our remembrance of the system of notation, which Prof. Jamieson desired to bring before the Congress, to influence us when we wrote that his criticisms repudiated the essential points of the International Congress system. In the former, for example, block letters were made to do duty, not only as symbols for physical quantities, but also to express linear dimensions; **B**, for instance, representing gausses, and **Lm**, length of magnetic circuit. In the later suggestions the same lack of method becomes apparent in the proposition to replace **H** with *H*, when considering the earth's field. As has been remarked by Prof. Hospitalier, what is wanted are logic and order in the formation of a terminology or notation, and there is a conspicuous lack of these essentials in the propositions of Prof. Jamieson. When we wrote that French script characters were found in every printing office, we were not aware that in England the French name of *caracteres rondes* was followed; with this change in name, it seems that the investigation of our contemporary confirmed our statement. We are glad that our contemporary recognizes that the Congress system is conceived upon intelligible, common sense principles, and betokens on the part of its author much care, and a painstaking appreciation of the subject. As to the "one man" qualification, it should be borne in mind that the man referred to was unusually fitted for the work, not only through his practical, theoretical and intellectual qualities, but also from the fact that he devoted several years of study with the distinct object in view of formulating a system of notation that would be not only scientific in its method, but of a character most adapted for international usage.

THE NATIONAL SCHOOL OF ELECTRICITY.

In another column we print a number of statements from gentlemen connected with the National School of Electricity, concerning its policy and work, and also a list of the instructors. We will here state that no assurance was necessary in regard to the good faith and disinterestedness of the members of the active faculty, nor is any needed as to the other gentlemen who, upon the inception of the enterprise, lent to it the use of their names. An educational scheme such as that proposed may, we believe, be made to accomplish an excellent purpose, and we can thoroughly sympathize with the aims of those who consented to support it, either by lending the weight of their reputations, or, in addition, by bearing part of the burden of its educational duties. The preparation of the lessons, it can readily be seen, has been no small matter as far as labor is concerned, and as their nature is such as to entail much drudgery, which, with one exception, we believe, has received no monetary remuneration, there can be no doubt as to the loyalty of at least the active members of the faculty to the ideal which had enlisted their support. The criticism to which the school has been subjected has had its source, not in the faculty, nor the instructors, but in the management. The lack of sympathy, so apparent among electricians, is, we believe, most largely due to the fact that the electrical profession, justly or unjustly, considered that the men who are now the managers of the School were officially responsible for the admittance of the electrical belt, hair brush, and similar exhibits to the Electricity Building of the World's Fair. Every electrician who visited the Fair felt humiliated at the sight of these exhibits in the temple of electricity and irritated at the thought of the probable effect on foreign visitors. It is but fair to say here that it is claimed that the responsibility for this most unfortunate and mischievous recognition of these articles at such a time and in such a place was "higher up" in the councils of the World's Columbian Exposition. Evidently, however, the electrical profession feels inclined to place the blame upon those it can reach, and it is not, therefore, to be wondered at that the antipathy felt toward those thought to be responsible should incline electricians to view with anything but favor an enterprise with which they afterwards became connected, and when one has an inclination to criticise, it is never difficult to find flaws. What we have said has not been in a spirit of criticism, but in explanation of the comparatively limited success of what, under favorable auspices, we feel sure would have found almost a boundless field of usefulness. In conclusion, as we now have the assurance that all the lessons are actually prepared by members of the faculty, whose competency is unquestioned, and that as the faculty also appear to choose the instructors, many of whom, as will be seen from the list we print, are well known in electrical circles, we can repeat what we said before, but without the accompanying qualification, that the school offers real advantages to those who desire to obtain general ideas on electrical science, or who wish to supplement their practical experience with a knowledge of the simpler points of electrical theory.

Technical Education.

So far as engineering of all kinds is concerned, says the London *Electrician*, there can be but little doubt that the decay of the old system of pupilage, and the rise of the new system of technical tuition has been brought about by the ever-increasing specialization of the engineering workshop, and the increasing impossibility for mere rule of thumb knowledge, engineering instinct, call it what you will, to hold its own unaided against minds with a sound scientific equipment and brains trained to reason accurately.

Electric Waves.

BY ALFRED G. DELL.

I have three Bunsen cells of medium size, bichromate of potash being used as a depolarizer, and a Ruhmkorff induction coil giving a one-inch spark. The current from the coil passes into the corner of each of two 12 by 14-in. brass plates, swung by silk threads; the plates are nine inches apart, and have stiff brass wires (No. 16) extending from the middle of one side of each to a spark gap of pointed gold wires, with rounded, not sharp, points. If the brass wires are pointed they will answer as well, only they are more difficult to keep clean. Back of the two plates there is a plate of sheet zinc extending nearly the whole length of the brass plates and about 1½ inches distant. A piece of sheet zinc, 2 by 3 feet, fastened in a wooden frame, is placed opposite to each of the brass plates, and as near to them as possible without touching; these are brought up until the spark gap just appears between two of the sides, care being taken that they are not close enough for sparks to pass into them from the coil.

As resonators I have two circles two feet in diameter, made of Nos. 16 and 18 copper wire, one having the wire extending from each side of the spark gap without a break, and the other broken directly opposite the spark gap, the wire being in two pieces, each about three feet long; both of these are fastened to wooden crosses. The spark gaps are made of small brass bolts, filled to points, not sharp but rounding, a small brass knob being fastened on each side to give them capacity, and the points being adjustable by means of the screw. With the above arrangement I obtain constant sparking in either circle at great distances, the magnetic and electric forces passing through the floor and walls. I can obtain bright sparking as far as I can go with a circle, provided that it is at all favorably situated relative to the large zinc plates. Such a circle will spark under the conditions given, so that it can be easily seen forty or fifty feet away, the force passing through the floor and plastered walls. I do not use a lens to see sparking, as it is bright enough to be seen five feet or more away at the greatest distance I can go. All Hertz's experiments with circles are thus easily obtained.

A Winter Carnival.

A grand Winter Carnival will be held in Ottawa, commencing January 21 and continuing until the 26th. The winter weather in Ottawa is practically the same as Montreal, where such successful winter carnivals have been held, and as Ottawa is the political capital of Canada, and beautifully situated, with a population of 50,000 progressive people, the city should be especially attractive to visitors. As Ottawa is also generally recognized as an electrical headquarters, and is said, in proportion to population, to have adopted electricity on a larger scale than any other city in America in its various domestic applications, the occasion will doubtless attract many electrical visitors. The management of the Carnival requests us to extend a hearty invitation to our readers to visit the city during carnival week, which we take pleasure in doing, and add our assurance that they will be well taken care of upon making themselves known to their electrical confreres in the vice-regal city.

Mr. T. Ahearn, managing director of Ottawa Electric Railway and a member of the American Institute of Electric Engineers, on behalf of the Carnival management, extends a hearty invitation to his fellow members and their friends to visit Ottawa during the week of the Carnival.

The National Electric Light Association.

The following partial list of papers to be read at the Cleveland meeting, February 19, 20 and 21, 1895, is announced:

"Some Economies in Electric Light and Power Stations," by Professor Edward Weston; "Arc Carbons and the National Electric Light Association Standard of Light," by L. B. Marks; "The Monocyclic System," by Dr. Louis Bell; "The Correct Method of Protecting Electric Circuits," by W. E. Harrington; "The Evolution of Arc Lighting Machines," by C. N. Black.

Mr. E. A. Leslie's paper, read at the Buffalo meeting, "The Operation of High Tension Currents Underground from a Physical and Financial Standpoint," will be taken up and discussed.

The Central Traffic Association has granted an application for excursion rates to the Cleveland meeting, to be, from all points in its territory to Cleveland, a fare and one-third for the round trip on the certificate plan. The other associations will undoubtedly concede the same rate, due notice of which will be given.

Patents and the Statute of Limitations.

The United States Supreme Court has decided that the statute of limitations holds against claims growing out of alleged infringement of patents, as well as against claims arising under other transactions.

In the case decided, one Campbell sued the City of Haverhill, Mass., for an infringegment of the Phillips patents for the improvement of pumps, and on the trial it was held that the State statute of limitations was a good defense to the claim. In announcing the decision Justice Brown, who delivered the opinion of the Court, said that the question had been decided both ways by Circuit Courts in about twenty cases, and the weight of authority was about equally divided. In the absence of any Federal statute on the subject the opinion of the Court was that in the several States their respective statutes of limitations should apply.

Journalistic Instructions.

A German electrical journal gives a very brief description of the now well-known method of heating metals by immersing them in a liquid and passing the current through it, the voltage of which is about 100. The description is so meagre that it misleads, but besides this it makes the absolutely incorrect statement that this phenomena is quite similar to what takes place when a workman in a foundry puts his bare hand in the moulten metal without injury. Whether the latter is possible or not need not be discussed here, but that it should be given as an analogy seems to us to be very misleading.

The Northwestern Electrical Association.

The third annual meeting of the Northwestern Electrical Association will be held at the Hotel Pfister, in Milwaukee, January 16th and 17th, 1895. This young organization has had a phenomenal growth since its inception and is continually increasing in strength. At the last meeting in St. Paul there were over 100 members present, and the promise is for a large meeting this winter. An interesting and profitable programme has been prepared, which includes the discussion of practical subjects. Space will be reserved for the display of electrical goods if application is made in season.

The Telephone Patent Situation—Still Another Note.

One of our contemporaries, noted for its championship of the Bell patents when they do not interfere with the telephone system commercially exploited by one of its own staff, criticizes in a recent number one of the statements in the article on "The Telephone Patent Situation," which appeared in our issue of December 29, 1894.

The first claim of the Thomas A. Watson patent, granted January 9, 1883, numbered 270,522, apparently covering all forms of telephone hooks which, in combination with an induction coil, break the call-circuit and cut in the telephone and transmitter circuit in one position and do the reverse in the other position, seems to be at the bottom of the criticism. This claim our contemporary, in its issue of January 31, 1894, characterized as "especially productive of insomnia" to the inventor, and later adds that "when a transmitter is employed that uses an induction coil the claims of the Watson patent would seem to cover the simplest switching devices in which springs are used, whether automatic or not." In an excess of zeal our contemporary evidently neglected the fact that the American Bell Telephone Company itself had three years previously found another method of using an induction coil transmitter which was not covered by these Watson claims, and that it had been gradually introducing this new method and abandoning the old Watson system. This point we brought out in our issue of December 29, 1894, and suggested that the "sleepless nights" over this Watson claim might be abandoned. In defense of its previous position, however, our contemporary assumes that the patent granted to J. J. Carty on March 31, 1891, numbered 449,106, and controlled by the American Bell Telephone Company, covers all other combinations of an induction coil transmitter, with the switch and calling and talking circuits, which are not covered by these Watson claims. By so doing it gives its readers a wrong impression. What the Carty patent does claim in reference to a subscriber's outfit on an individual line is:

"A telephone station apparatus comprising a permanently continuous conductor uniting the main line terminals of said apparatus, an electromagnetic call instrument included in the circuit of said permanent conductor, two normally open or discontinuous branch circuits also extending between the said terminals and adapted

when closed to form additional connections between them in parallel circuit with the said permanent conductor, a call generator included in one and a telephone included in the other of said normally open branch circuits, means, as indicated, for closing the generator branch circuit, and other means for independently closing the telephone branch circuit, substantially as described and for the purposes set forth."

But the object of this invention of Carty's was the improvement of party lines; thus in the language of the specification:

"The object of my present invention, broadly stated, is in a *multiple station circuit* to arrange the apparatus in a parallel circuit, etc."

The first claim of this patent covers broadly such a *multiple station* telephone circuit. After quoting this broad claim and forgetting that it is for a party line system our contemporary concludes, "We cannot, however, quite endorse his (THE ELECTRICAL WORLD'S) proposed remedy for insomnia, which consists in avoiding a patent which runs out on January 8, 1900, and in infringing a better and more recent one which does not expire until 1908." The absurdity of such a statement may be well seen by a comparison between the old Watson claims and claims 8, 9 and 10 of the later Carty patent. Does our contemporary wish to give its readers the impression that an induction coil transmitter can be combined with the hook and signaling and talking circuits in only these two ways?

Symbols and Abbreviations.*

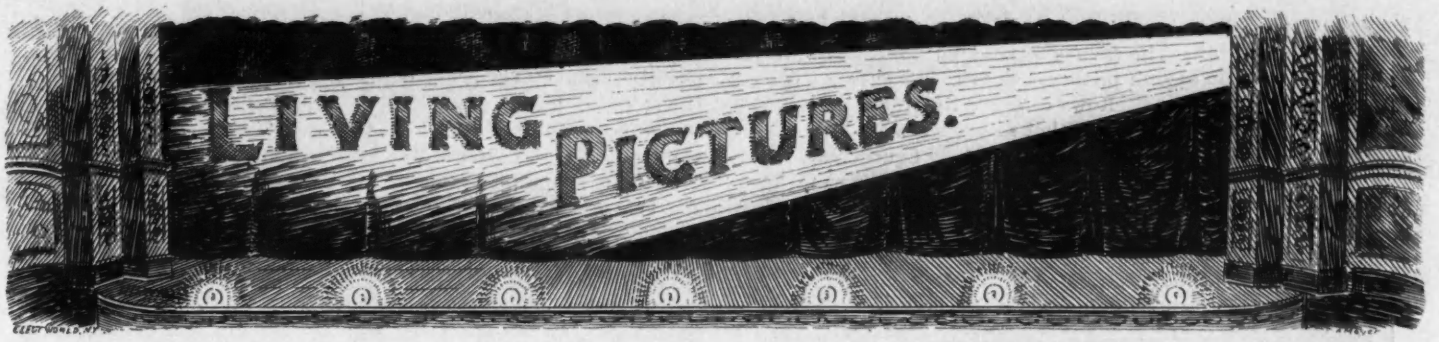
Our esteemed American contemporary, THE ELECTRICAL WORLD, in its issue of November 24, again returns to the attack, by way of rejoinder to our leaderette of November 2. We really cannot compliment our contemporary on this reply, as regards either accuracy, tone, or pith. For example, it says: "Prof. Jamieson was at Chicago, we believe, and must have been aware that the system of Prof. (*sic*) Hospitalier was to be brought before the chamber of delegates. He should then have entered his objections, which he certainly could have done through one of the delegates." . . . "Finally, the system of Prof. Jamieson was embodied in a paper read before the Congress. . . ."

The facts of the whole case are these: Prof. Jamieson was at Chicago, and was aware that M. Hospitalier's system was to be brought before the chamber of delegates. Further, he offered to read a paper on the subject before the Congress, and his offer was accepted. Before leaving home, accordingly, he had a large number of slips printed, in illustration of the views he meant to set forth. On his arrival at Chicago, he was informed by those in authority that, seeing that a committee had been formed to consider the whole subject, it would be neither just nor proper to discuss it at any of the ordinary meetings. In this view he acquiesced, the more willingly because he was given distinctly to understand by delegates occupying official positions, that the committee, before submitting their decisions to the delegates, would give to all members interested in the subject ample opportunity of expressing their views. Shortly before the committee met, however, it transpired that they had finally decided not to hear the views of any one on the subject, and to hold their meeting *in camera*. Prof. Jamieson immediately sent to the committee's secretary the printed proofs which he had had prepared, with the request that he would distribute them amongst the members of the committee. This the secretary unfortunately omitted to do, for after the meetings the whole of these slips were found intact at the bottom of his hand-bag! The upshot of all this secrecy was, that nothing about the committee's proceedings was divulged until after they had presented their report, and even then no reliable information was imparted to individual members. True, a short report of the meeting, accompanied by a table of symbols, etc., appeared in THE ELECTRICAL WORLD of September 23, 1893 (*i. e.*, fully three weeks after the termination of the Congress), but as Prof. Jamieson had then no means of verifying its authenticity and accuracy, he took what he was undoubtedly justified in doing, the very earliest opportunity of criticising the complete and authentic recommendations of the committee. Our contemporary is not accurate when it alleges that "the system had been before the world for some years; it had been formally brought in 1891 before the Frankfort Congress, and was by it referred to a committee for report to the next Congress, and it was published by the committee on the Provisional Programme for the Chicago Congress *in order to invite discussion. It is rather unreasonable, in the light of this, to imply that there was not ample opportunity to publicly criticise the measure.*" (The italics in the above quotation are our own.) We quite admit that a system was brought before the Frankfort Congress by M. Hospitalier in a paper which he read there; but that it was "before the world," as a complete proposal, we do not admit. Further, it was referred to a committee, not for report to the next Congress, but "to examine this system . . . in a general way, and to submit it to practical tests; to publish shortly in the special technical journals the results of their examination, with a view to a common understanding, and to leave it to the next Congress to establish definitely this system of notation." How far this committee has fulfilled its functions we leave it to the public to judge. Had they even gone so far as to publish an account of the proposed scheme in the technical journals, it would have been better than nothing, and would have afforded ground for discussion. With regard to the statement that "it" was placed on the Provisional Programme in order to invite discussion, we should like to offer two remarks. The general subject of "The consideration of an International System of Notation, etc.," undoubtedly was there, but certainly not any particular system whatsoever; discussion may have been invited, but instead of being accepted it was burked. The foregoing remarks will serve to show how much opportunity has hitherto been given for a fair expression of opinion, or what pains have been taken by the committee to ascertain what other people thought. Our criticism of the constitution of the committee—as an international one—was certainly called for, and is amply justied by the list of names as given by THE ELECTRICAL WORLD, viz., Ferraris, Ayrton, Carhart, Hospitalier, Palaz, A. Siemens and Budde. The only real Britisher on the committee is Prof. Ayrton, and he, unfortunately, was not able to be present at a single meeting! Moreover, Profs. Carhart and Hospitalier are the only two men in the above list who have made anything like a special study of this matter, and who could be designated "experts" in electrical notation.

Apart from all these considerations, however, we admit freely and fully that the system is about as good and as perfect as such a "one man" system can be. It is conceived upon intelligible, common sense principles, and betokens on the part of its author much care, and a painstaking appreciation of the subject. Much credit is due to M. Hospitalier for his earnest labors in constructing it, and to our contemporary for really making it known to the electrical world. But whilst admitting all this, we do not thereby relinquish our right to criticise the system as a whole, or in part, and we are quite at a loss to imagine why it is that our contemporary accepts with such a poor grace the remarks that have already been made. We have said this much by way of justifying our own and our correspondent's position in this matter, and we consider that we have succeeded in showing that the present is undoubtedly the best, because it is the earliest possible time for criticising the whole system.

Our contemporary remarks that the criticism of Prof. Jamieson "repudiates almost every essential point of the International Congress system." We have again looked carefully over that criticism, and we cannot make out how any fair-minded man can see in it a repudiation of any essential point whatever, unless it may be the matter of so-called French script *versus* gothic (so-called "block") letters. How far that matter is considered essential, even by M. Hospitalier himself, may be gathered from his article on the subject in THE ELECTRICAL WORLD of August 26, 1893, in which he avows his preference for the former (French script) on account of the time required in writing these latter characters with the pen or on the blackboard!" We have been making inquiries at some of our leading printers who have had large experience in scientific and mathematical work, and not one of them ever heard of *French script*. Moreover, we have turned up the illustrated lists of various type founders, and cannot find these characters. There are many forms of script letters, but none termed *French script*, the nearest approach to it being here known as *Ronde type*. No two founders, however, make them exactly alike. All printers, however, have the plain, bold gothic letters, and are well acquainted with them. With all deference to Prof. Hospitalier's opinion we consider still that the well-known, easily written and distinguished gothic (or *block*) letters ought to be appropriated to the oftener used and more important magnetic quantities; and that the various quantities pertaining to light (which are comparatively seldom used here) will be much more appropriately represented by the lighter, more fanciful *French script*. The remainder of Prof. Jamieson's criticisms was directed to what he conceived to be faults of detail, rather than errors in principle. It is all very good to have a thing constructed on right and proper principles, but if it is to be a workable scheme, it must be carefully elaborated in its details, so that nothing which is likely to cause confusion or misunderstanding, or needless worry, may have a place there. We consider that we have done no more than our duty if we have succeeded in directing public attention to the manner in which this most important matter has been carried through.

* From the London *Electrical Review*.



THE Living Pictures as we now have them are the very latest development in decorative lighting effect. Modern stage lighting has advanced more in the last decade than it did in all its preceding history. This is due in large measure to electricity, which from its very nature offers advantages never to be obtained from gas. In stage lighting, rapidity of manipulation is the most important element to be considered. Hence, the advent of the current opened up avenues of accomplishment of which the old theatrical "gasman" never dreamed. It is safe to say that had the latter old-time functionary been confronted with the problems which the electrician of Koster & Bial's had to solve, he would have pronounced them unsolvable. And so they would have been under the old regime. Under the new, however, they come easy and with a little explanation any one may make "Living Pictures."

All the world has seen them—from the front. The "grand old masters" have enjoyed a new lease of life as far as the gallery is concerned. The projectors of the scheme have in some measure sought to pander to a certain element by making the exhibition an illustration of the "preponderance of the nude," but with those spectators who do not hold nudity and nakedness to be synonymous this will not count. There is plenty of eminently proper subjects, and besides we have to do only with the part that electricity plays in the matter.

There are several cardinal points to be remembered in making Living Pictures. The original picture must be studied and followed n every particular. No tint or shade which the artist has introduced must be omitted. His high lights are not more important than his shadows. The combination of colors must be reproduced. The relation of one figure to another must be the same. Unimportant objects must not overbalance the principal figures. The picture must tell precisely the same story as the painting, and due account must be made for the fact that the audience is removed from the scene of action. Comparatively so, that is, and in this case the scenic artist had an element to contend with that did not concern the original painter.

The electrician is the real artist in this case. His lights are everything. The scene painter tells him that he will want this or that effect produced; more light here, a shadow there, a tint at this point, a deeper tinge at that. He is to remember that these subordinate figures are to be in shadow, and at the same time strongly enough defined to allow the audience to take in every lineament of their form. If they are just so strong, then the highly lighted figures at the front must be all the stronger. How is it to be done? The secret lies in the fact that Living Pictures are examples of highly exaggerated lighting effect. Let the electrician remember that shadow depresses and light tends to make the object prominent.

We will select, for instance, a picture in which the principal object is the nude figure of a girl. It will be necessary to bring this figure into vivid contrast with its surroundings. These surroundings must show out well also. All that is necessary will be to throw a good light upon them. This will bring them out. Then an intense reflected light is thrown upon the figure of the girl alone. It practically lifts it out of the picture, making it the most prominent figure. The other figures appear to be in shade, yet they are not, as a matter of fact, and are plainly discernible to every one in the audience. This is one of the main effects. Another point to be considered is the avoidance of shadows. The intense light from the reflectors might cause a shadow to fall where it did not exist in the original painting. To counteract this effect, lights must be placed at various points so that the shadows shall be dispersed. At the same time it may be necessary to throw a shadow. There must be a special arrangement for this purpose. Then there are isolated lighting effects, such as the interior of a house, or perhaps a gas lamp. Lastly come the color effects.

The Living Picture seen from the front presents one or more

NOON, MORNING AND NIGHT.

large gilt picture frames in which are grouped the models. This is all the audience sees. The frames are fronted by black curtains which are pulled aside as each picture is shown. Each frame is part of the electrical equipment. Rows of lamps line the back of the frame, out of sight of the audience, but so placed as to cast an intense light upon the figures in the picture. The figures themselves stand back from the frame a distance of two, three or more feet. The background to the picture is painted upon canvas and is semi-circular, wedge, half-pentagon or half-octagon in shape, as may best suit the occasion. Just above the front of the frames is a bridge on which stand the electrician and his assistants. It is out

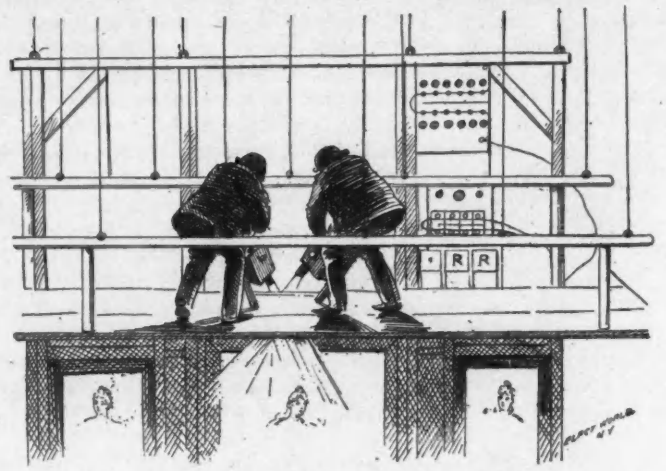
GOOD-NIGHT. (*Birket Foster.*)

of sight of the audience, being protected by a drop curtain which reaches down from the "flies" to a position just below it. The three frames at Koster & Bial's are secured to a large scaffolding framework which can be hoisted up into the "flies" while the other performances are going on. The last picture of the series is presented in an immense gilt frame which has a scaffolding framework of its own and is lifted up out of the way in the same manner as is the one in which the three smaller gilt frames are secured. When the scaffolding containing the three frames is lowered to the stage, a small switchboard which controls the lights in the pictures and which is attached to the framework stands

TURN-TABLE CARRYING FOUR LIVING PICTURES.

directly on a level with the bridge on which are located the electricians. Wires run from all the lamps up to this switchboard, where they are controlled by cut-outs and switches. A "flexible" extends from the "mains" which run along the bridge and is plugged into the switchboard on the framework. Thus current can be had in a second after the framework is lowered into position.

The bridge carries an extra switchboard of its own to control the arc focusing lamps which are used to cast an intense glare on certain figures in the pictures. On the bridge also is a variable resistance for graduating the intensity of the light. The centre frame of the series of three has three circuits, red, white and blue, down each side. There is also a circuit of white lamps along the base of the frame. Two extra circuits of white lamps are on the sides of the frame, but they are around almost on what would be considered the outer edge of the frame and throw their light further back on the picture. This makes nine circuits in all. The two smaller side frames are only shown once during the evening, hence the effect is never varied, so there is only one circuit of mixed colored lamps —30 lights at the top, 15 along the base and 8 along each side. The centre frame has forty lamps on each side. Hanging from the bridge is a flexible, ending in a plug which is to be used in case there is some individual lighting in the picture to be done. In that case there are wires running from the individual lamps in the picture to a socket in the frame-work beneath. The plug is then fitted into the socket and the current controlled from the bridge above. Branching away from the mains are lines to a Ward lamp which is suspended from the paint-bridge at the back of the stage.

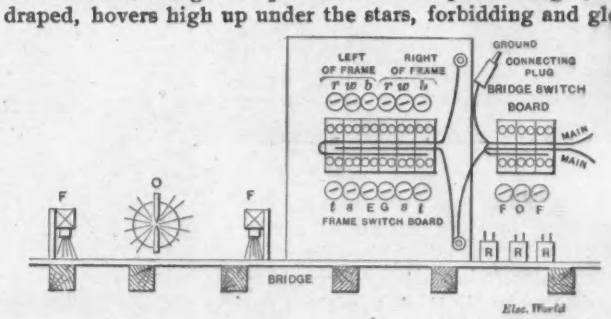


WORKING FOCUSING LAMPS ON BRIDGE.

This is for transparencies such as sun or moon effects in a background of sky.

Now for the pictures themselves. Each picture is grouped on a platform which is then rolled into position on the stage behind the picture frame. The platform most used is a turntable affair which presents four pictures before it is removed. The scenery on it is in the shape of a four-pointed star. Each group reposes in the space between two points of the star. Thus the background is V-shaped, the audience looking into the V. Other platforms have the scenery arranged in the shape of a half-pentagon or octagon. The turn-table platform is the best for suggesting how the entertainment is conducted.

The three pictures—"Morning, Noon and Night," after Mackart —form a good subject for illustration. The central and largest frame shows "Morning." Two disheveled female figures—one above the other—float above the gray clouds, which latter are beginning to be lighted by the flambeau held in the upstretched hand of the upper figure. "Noon," in the frame on the left, is the sun at full power—a female whose flowing hair becomes the rays, enveloping her form and streaming to all points of the compass. "Night," heavily draped, hovers high up under the stars, forbidding and gloomy.



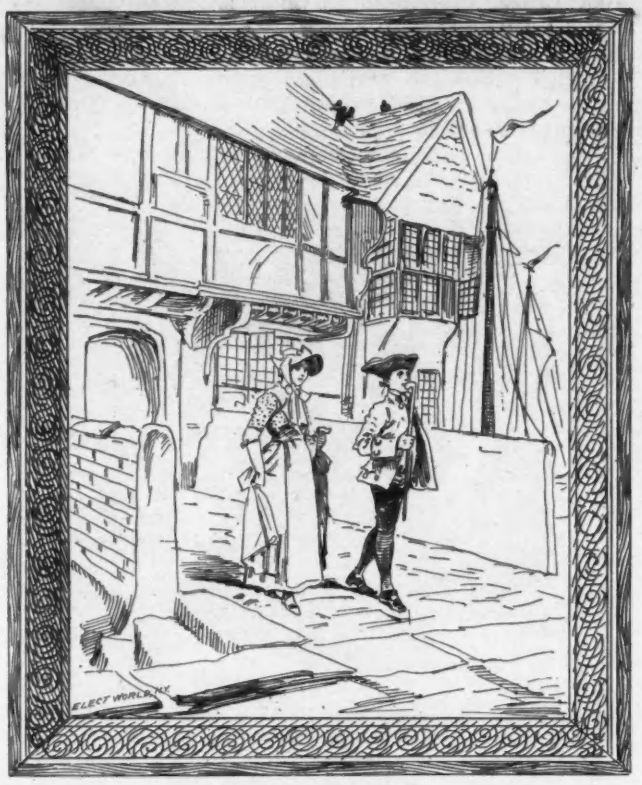
FRONT VIEW OF LIGHTING BRIDGE, SHOWING SWITCHES, &C.

The general illumination of "Morning" comes from the white lights around the edges of the frame. These in themselves are enough to light up the figures of the girls. But it is necessary to lift them out by means of the focusing lamps, therefore an intense light is thrown on them from the bridge. To the casual observer the background of "Morning" looks dim. It is only an optical illusion, however, created by its contrast with the exaggerated light thrown on the two female forms. The torch in the hand of the upper figure gets its light by means of an incandescent lamp, the current to which comes through a bifurcated wire running down back of the figures. This is where the flexible, hanging from the

bridge, comes in. It is plugged into the framework of the turntable.

"Noon" is a generally illuminated picture with the central figure highly wrought. "Night" differs from the others in that its background is less clearly defined. The main figure is, of course, acted upon with the focusing lamps. The background of sky is dark except where small holes in the canvas allow the arc light behind to give the appearance of innumerable stars.

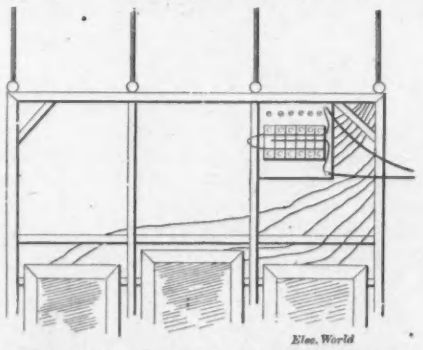
Everybody has seen the "Rock of Ages," that wonderfully draped



SALLY IN OUR ALLEY.

figure, clinging to the cross, with the plunging surf roundabout and the light of hope streaming upon it from above. It is one of the best of living pictures. Its lighting effects explain themselves. The heavy glare from above is self-evident. The waves, the cross, the figure, rest under a glare of light. Even the despairing hand reaching from the water in the foreground feels its influence.

"Salambo," by Gabriel Ferrier, is still more interesting from the lighting standpoint. The story of the beautiful ancient, beauti-



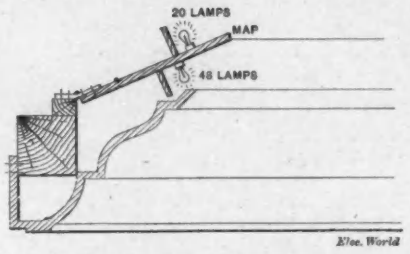
PLAN OF SUPPORT FOR PICTURE FRAME.

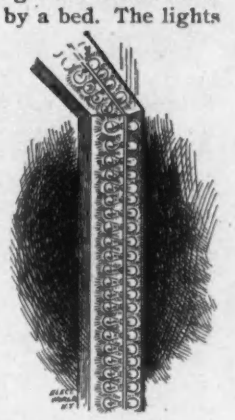
fully told by Flaubert, is very realistically depicted. "Salambo," a naked woman, is in the power of the prophet snake. She is wrapped in its coils and its head is pressed against her cheek. Moonlight streams in on the temple floor, and a slave crouches in the background, where he has lighted an incense burner. The stars have come out. It is night.

There was a variety of effects to be obtained in this picture. The girl was first lifted out with the focusing lamps. The slimy appearance of the snake was obtained by means of varnish, and further heightened by means of a blue lamp placed behind the reptile and out of sight of the audience. A red lamp from a brazier at the side and another behind a pillar brought out the peculiar glow of the incense burner and mingled with the moonlight on the floor. Thus, the slave's face had two tints, reddish from the brazier on one side and bluish from moonlight on the other. The stars were formed by placing lamps behind holes in the background of canvas.

Suppose there is to be no lifting out with the focusing lamps as before, and that a shadow is to be thrown to one side. How easy it is to accomplish this by judiciously cutting out circuits on one side of the frame, until the lights on the other side predominate enough to throw the required shadow. Stage lighting is reduced to a science in the Living Pictures. Almost every effect ever produced is used here, always exaggerated, and yet never seeming to be so.

"Evening Prayer," after Birket Foster, is a good illustration of how shadows are thrown. A child is kneeling by a bed. The lights come from one side of the frame. The other side is left dark. "Sally in Our Alley," after an illustration by Henry E. Abbey, has little shadow in it, so behind the house and the balustrade, bunches are





SECTIONAL VIEW OF FRAME AND ARRANGEMENT OF LAMPS.

placed to dispel all shadows. This is but a small part of the manipulation, and when it is known how much there is to the proper presentation of each picture, one wonders that they are produced so quickly. The workmen behind have less than a minute in which to make all connections as each picture is shown. In fact, this time is all that is allowed from the exposing of one picture to that of another. Everything is adjusted to a nicety, the water in "La Source," a brook scene, is run through a hose to the platform, where it is coupled to the stationary pipe by means of a railroad air-brake coupler.

The theatrical electrician must be well up in local expedient.

ROCK OF AGES.

In a series at the above named concert-hall was a picture of Andromeda crossing the rocks at the seashore. In the original picture her hair was represented as flowing in the wind. In the living picture it really was so, the feat being accomplished by means of an electric fan placed just behind the gilt picture frame. A short time ago one of the pictures presented was "Luna." The moon was quarter full. A dim ring of bluish light showed the

outlines of the whole moon. The middle part was bluish black. The quarter of the moon that showed was composed of the form of a girl bent into the required shape. The figure was "lifted out" with the focusing lamps, the rest left in comparative darkness. It was a transparency picture. Luna fitted into the hole that was cut out for her. The rest of the picture was lighted from behind. But in order to get a proper gradation of light around the edges, the latter were lined with fringed paper, cut so as to gradually separate the light from the darkness. Such is the value of expedient.

The wiring here is in simple multiple. The theatre has its own generating plant. The wires run along the sides and top of the picture frames and up to the simple switchboard at the bridge, where they are protected with cut-outs. It is a very simple affair after all. Standing on the bridge, under the switchboard, are a set of resistance boxes—two wire and one Carpenter carbon resistance. They are right at hand and under the electrician's control. There are three Ward "photograving" lamps in use. The focusing lamps were built in Paris by the French Edison Company, especially for use in producing "Living Pictures." The focus is instantly adjustable and can be fixed in a moment, a very necessary quality, as each picture has to be treated differently. They are held in the hands while being worked.

The inspiring genius of the lighting effects at Koster & Bial's is Mr. Chas. Meulenbergh, a native of Germany and a graduate of the Columbia School of Mines. He it is who has so much contributed to the great success of the Living Pictures by his admirable and judicious arrangement of the lamps. The scenic artist is Mr. Albert Operti, who is famous enough to need no further introduction.

Perhaps the gallery might have some trouble in determining the names of the different subjects as they appear were it not for a happy thought of the management. That is, to use a condensing lens and lantern, by means of which the name of each picture is thrown in letters of light on the black curtain just before every change of scene.

Electrical Power Transmission—VIII.

BY LOUIS BELL, PH. D.

Power Transmission by Constant Currents.

34. In its general aspect this method must now be regarded as a makeshift. It came into existence at a time when the only circuits extensively installed were those for arc lighting, and hence, if motors were to be used at all, they must needs be of the constant current type. As incandescent lighting became more common the arc motors were gradually replaced by shunt motors worked at constant potential. A few constant current plants, especially for motor service, have been installed both here and abroad, but for the most part they have merely dragged out a precarious existence, and are probably doomed to abandonment.

There is good reason for this. The motors at best regulate indifferently, and there is serious objection to running high voltage wires into buildings when it can be avoided.

The objections of the insurance companies alone are quite sufficient to discourage the practice. The constant current has often been advocated for long distance transmission of power where high voltage is a necessity. For such service the method has the great advantage that the motors do not need extraordinary insulation except from the ground. A constant potential service at 5,000 volts continuous current would be utterly impracticable, if distribution of power in moderate units were to be attempted, while with constant currents it is entirely feasible, although objectionable on the grounds mentioned. In addition, unless a proposed transmission be for power alone, the constant current method shares with constant potential of high voltage the very grave difficulty that an incandescent lamp service is out of the question, without secondary transformation of the necessarily high line voltage to a very moderate pressure. This is difficult and costly with continuous currents of any kind, and doubly so when the troublesome question of regulation at constant current is involved.

35. To reduce the energy sent over a high voltage continuous current line to a pressure at which incandescent lamps can be fed, two methods are generally available. We may pass by the plan of using many lamps in series as of very limited applicability and forbidden by the fire underwriters. First, the required power may be received by a motor of appropriate size, which is belted or coupled to a low voltage generator. This device does the work, indeed, but it involves installing three times the capacity of the lamps desired in machinery of a somewhat costly character, and losing in the motor and generator fifteen or twenty per cent. of the energy supplied from the line. The other alternative is to employ a composite machine combining the functions of motor and generator. This piece of apparatus is variously known as a motor generator, dynamotor, or continuous current converter. It is a dynamo electric machine having a double wound armature and two commutators. One winding with its commutator receives the high line voltage and operates as a motor. The other winding and its commutator furnishes, as a dynamo, low tension current. The field is common to both windings. Fig. 22 shows a small machine of this kind, adapted to receive 5,000 volts from the line, and to deliver 110 volts or *vice-versa*.

This particular machine works at constant voltage on both circuits. Either circuit, however, could be made to work at constant current, provided the means of regulation for this purpose were so chosen as to leave the field and speed unchanged.

The cost of a motor generator, while less than that of two

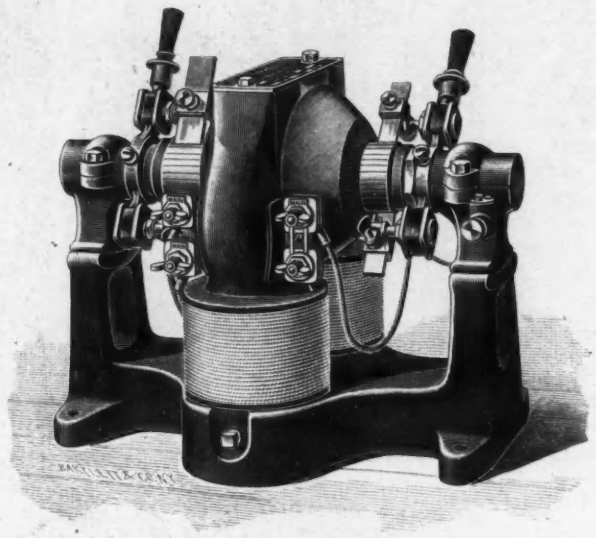


Fig. 22.

separate machines, is still high, and although its efficiency is somewhat greater than that of the pair mentioned above, it is obtained at the cost of a rather complicated armature, which, moreover, rom a practical standpoint, is quite objectionable.

36. In spite of the difficulties incident to working incandescent lamps from a high voltage constant current circuit, the ease with which such circuits can be worked, even if for power alone, at voltages far above those available on the constant potential system, encouraged their installation during the period between the first efforts at long distance transmission and the very recent date at which alternating current apparatus has become thoroughly available. For some years it was constant current or nothing, so far as long distance transmission, coupled with distribution, was concerned.

As a result of the various adverse conditions mentioned, transmission at constant current has never made really any headway in American practice, and at present the method is followed to a noticeable extent in only one locality—San Francisco. There, through the activity of local exploiters, constant current power circuits have been established and have been in fairly successful operation for several years.

(To be continued).

A New Application of the Telephone.

A London engineering journal states that "the telephone is made use of on Australian sheep ranches, in some of which the sheep and shepards are watched and given instructions telephonically by means of six or more stations, all communicating with a central point." We are not surprised to hear that the telephone will transmit the language of the sheep, and that they can be given instructions telephonically, but it seems to us that it would require a sort of boss sheep at the transmitor, unless the shephard can talk the sheep language; the most surprising part is that in Australia the sheep may be seen through a telephone.

A New German Scientific School.

Dr. Nernst, who was offered a chair at Münich, has declined it, having been informed by the Minister of Education that a Physico-Chemical Institute will be shortly started at Göttingen.

Long Distance Telephony.

BY F. W. DUNBAR.

THE factors of all others, it has been truly said, which give confidence and stability in our modern business methods, and stimulation and activity in our business transactions, are the instantaneous transmission of news and thought between distant points. And of all the known methods of communication at a distance, the possibilities of the telephone as furnishing a natural and satisfactory means of instantaneous communication can be certainly placed in the front rank.

The telephone as a toy had long been known, when suddenly by the introduction of electricity its era was at once marked as a commercial factor in the progress of the civilization of the world. The old whispering galleries were nothing more nor less than the telephone in its first crude form. The energy of the voice was concentrated and directed along a certain path, and then condensed at a distant point, instead of being allowed to radiate out in all directions and thus waste itself in useless vibrations of the air.

The next step in advance was the mechanical string telephone, or lovers' telephone, by which the better conductive power of a tightly stretched string or wire was utilized to conduct the sound waves which were concentrated upon a vibratory diaphragm at the transmitting end, and reproduced upon a similar diaphragm at the receiving end. But the string or wire, while far superior to the air was still, even at best, a poor conducting medium, because of the great loss in the energy of vibration which necessarily occurred upon it during the transmission of the sound waves. Thus the distance to which audible conversation could be carried on was limited by this great loss upon the conductor. It was at once seen that until this loss could be reduced, the telephone would have to remain a toy.

When the laws of electrical induction and conduction became known, brilliant minds perceived that the solution was at hand; for the energy of the vibrating diaphragm could be transformed into electrical energy at the transmitting end, and this *electrical* energy could then be transmitted over long lines with incomparably less loss of energy than could the mechanical vibrations or sound waves. It was only necessary to place similar apparatus at the receiving end to retransform this transmitted electrical energy back into mechanical energy, and thus the receiving diaphragm would then reproduce the same sounds which were impinged upon the transmitting diaphragm.

Fig. 1 shows this important step and is simply the familiar magneto transmitter and receiver of Alexander Graham Bell, which was thrown open to public use nearly a year ago. The method of the transformation from the mechanical energy of vibration of the diaphragm to the electrical energy of the circuit and back again is now a well-known process. It will be noticed that as the iron diaphragm, *D*, is forced toward the soft iron pole piece, *I*, which is

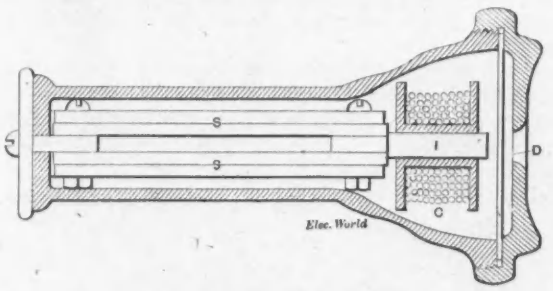


FIG. 1.—THE BELL TELEPHONE.

in magnetic contact with the permanent magnets, *S*, *S*, the magnetic flux or "lines of force from these permanent magnets will be increased through this core, *I*, owing to the formation of a better return magnetic circuit through the iron diaphragm and back to the other end of the permanent magnet. As the diaphragm recedes from the pole piece the magnetic flux through this pole piece or core, *I*, will decrease. A coil of wire, *C*, is placed around this core, and when the instrument is in use it forms part of the electrical circuit running to a similar coil in the receiver. When used as a transmitter the opposition to the forced vibrations of the diaphragm which is offered by the inertia of this changeable magnetic flux through the core and the surrounding closed circuit coil appears, with certain losses, as electrical energy in the circuit. This electrical energy, transmitted with certain slight losses, acts upon the diaphragm of a similar instrument used as a receiver at the distant end of the circuit and causes its diaphragm to vibrate similarly to the diaphragm of the transmitter, but with less energy.

Now, it is obvious that in all of these classes of instruments, whether mechanical or electromagnetic, it is the energy of the *voice* which is transmitted, and the received sound, owing to certain unavoidable losses, must be weaker than the transmitted sound. It is also equally true that no purely electromagnetic transmitter can be made which will transmit as loudly over a short, very short, line as will an equally well made mechanical or string telephone. The advance in the art up to this point has been simply one of *reduced loss* upon *long* transmitting circuits, and has offered no solution to long distance telephony.

Practically simultaneously with Bell's telephone came that invention which has made long distance telephony a reality, *i. e.*, the battery transmitter, the public use of which Judge Carpenter, in his recent decision against Emile Berliner and the American Bell Telephone Company, has just offered to the public as a fitting Christmas gift. By means of this invention it is no longer required that the voice itself should furnish the energy which passes out upon the line to the distant point, but it allows a separate source of power, a battery, to furnish the energy which is thrown out upon the line and required to traverse such immense distances, and the function of the voice is simply to choke or throttle this energy in a rhythm identical with the rhythm of the voice itself. The importance of this invention will be appreciated when we consider the difference

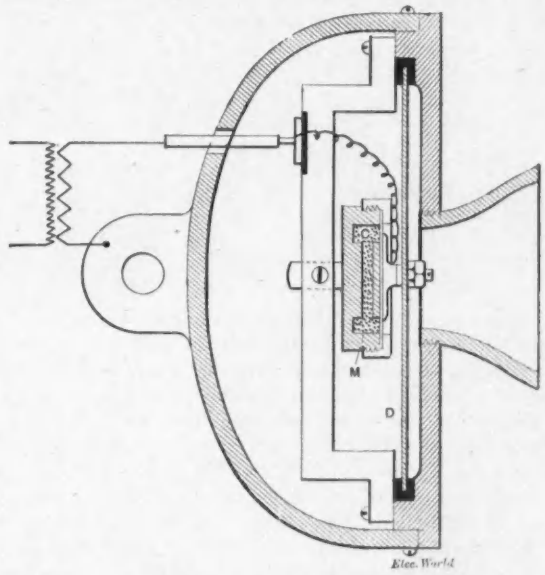


FIG. 2.—THE BATTERY TRANSMITTER.

in the available energy between a hand car and a steam locomotive. In the one the energy is furnished by the muscular power of the operator, and in the other the muscular power of the engineer is simply used to vary the opening of the throttle valve, and a separate source of energy, the steam boiler, is allowed to do the work. The method by means of which the energy from the battery is throttled or varied is briefly as follows:

In the battery circuit is placed a resistance varying medium, such as granular carbon or some similar substance, the electrical conductivity of which varies with the intimacy of contact and number of contacts of the granules. If, now, the diaphragm of the transmitter be allowed to communicate its vibrations directly to this resistance varying medium, the current from the battery will be caused to vary in a rhythm similar to the rhythm of the vibrating diaphragm. Fig. 2 shows such a transmitter and is similar to the transmitters which have been found best adapted for long distance telephony. *D* is the diaphragm receiving the sound waves from the air and transmitting them directly to the front electrode of a circular box, whose cavity, *C*, is partially filled with granular carbon. The back electrode is rigid and is connected electrically through the framework of the transmitter to one side of the battery. The front electrode, which is firmly attached by means of a small bolt and nuts to the vibrating diaphragm, carries a small, thin mica disc or diaphragm, *M*, clamped at its edges. This mica disc gives sufficient freedom of motion to the electrode and confines the carbon granules in the box. This front electrode and diaphragm are insulated and

connected electrically to the other pole of the battery; first passing through the primary, or low resistance side, of a transformer or induction coil. The functions of this transformer are twofold: First, it allows a greater output, and consequently a greater variation in energy, from the battery by maintaining the battery circuit of low resistance; and, second, it transforms this variation of energy.

The important point to be borne in mind is that the energy which may be transmitted to the distant end of the circuit by such a transmitter is only limited by the mechanical and electrical construction of the instruments and is not directly dependent upon the energy of the voice. In fact, voices and music have been transmitted to distant cities and heard there with a greater volume than were the original sounds at the transmitting end.

Fig. 3 shows the arrangement of the essential apparatus for conversation by long distance telephony. The signaling devices (bells and generators), lightning protectors, switchboard apparatus, etc., are omitted for the sake of clearness. It will be noticed that the apparatus at each end is similarly arranged, and that the primary circuit of each transformer, *C*, contains the transmitter *T*, and battery *B*. The secondary circuit of each transformer passes directly to the line circuit and includes the receiver *R* on one side. Thus each party during conversation will hear his own voice in his receiver with the full energy of the current which his transmitter sends out to the line, but will only hear the voice of the distant party with a diminished energy, due to the loss upon the circuit. This loss of energy is caused by the electrostatic absorption of the current

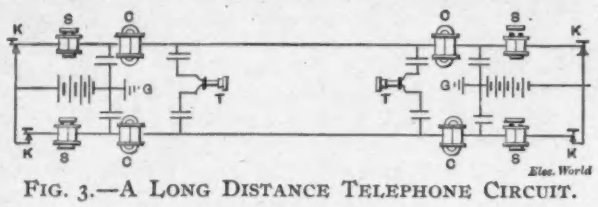


Fig. 3.—A Long Distance Telephone Circuit.

upon the circuit, and has been found to be of such magnitude upon very long lines as to apparently justify the use of copper wires for such circuits of a size sufficient to transmit many million times the amount of energy which they actually convey. Another great problem which has been commercially solved is represented also in Fig. 3.

If two or more long distance telephone circuits are carried side by side on the same pole lines, and no especial provision is made to the contrary, it is found that the inductive disturbances from one circuit to another—"cross-talk," as it is familiarly called—are so great that but one circuit can be commercially used at a time, owing to the confusion of voices. But if the circuits are "transposed," as shown in Fig. 3, so that each side of each circuit is, on the average, equidistant from each side of all other circuits, then the cross-talk is eliminated. Although the problem is readily solved for two or three circuits, it grows more and more complex as additional circuits are added. In general, it has been found that at least one transposition per mile on each circuit is required to successfully eliminate the trouble.

Another problem, which, from its practical and commercial importance as well as scientific fascination, demands some attention. This is the simultaneous transmission of telephonic and telegraphic messages over the same circuit without mutual interference. Fig. 4

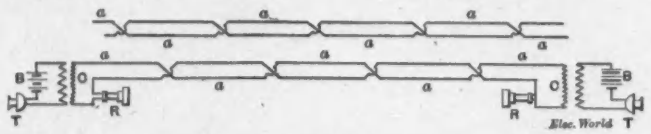


Fig. 4.—Simultaneous Telegraphy and Telephony.

shows the method of Van Rysselberghe for accomplishing this object. The apparatus is the same for each end of the circuit, and by its use each side of a telephone circuit is used as a separate telegraph wire, while the metallic circuit is used at the same time for telephonic purposes. *T* represents the telephonic apparatus which is shown in greater detail in Fig. 3. At each end of the main line circuit this telephone circuit is connected to the main line through condensers as shown. These condensers allow free passage to the rapidly alternating telephonic currents, but effectually bar the passage of the Morse signals from one side of the circuit to the other, and thus prevent any interference between the two telegraph circuits. *S* and *K* represent the standard relays and keys which are used in ordinary telegraphy. *C* represents the special retardation coils which are used both for "rounding off" the abrupt Morse signals, and thus rendering them inaudible in the telephone circuit, and also for preventing the rapidly alternating telephonic currents from taking the shunt path from one side of the metallic circuit to the other through the relays and keys of the two telegraph stations situated at the same end of the metallic circuit. The other condensers, which are shown legged to ground, aid in decreasing the abruptness of the "kick" at the "break" in the Morse signals, and thus farther soften or round the Morse characters, which would otherwise be audible in the telephone circuit. With circuits thus arranged, allowing the simultaneous use of two Morse lines with each telephone circuit, the earning capacity of each pair of wires is seen to be enormously increased.

Current and Potential.

BY W. M. STINE.

An editorial in The Electrical World of December 29, 1894, together with two letters bearing on the question of the generation of an E. M. F. on open circuit, are suggestive of some aspects of the subject of potential and current in general. It is not the intention of the writer in any way to enter into the discussion between Messrs. Waddell and Pierce, but simply to state some phases of a subject to which but little attention is directed.

Potential may be defined as a condition of ether stress, while an electrical current is the equalization of this stress through a conductor, or substance, whose dielectric resistance approaches zero.

Lenz's law is usually stated by saying that whenever a *closed* circuit, capable of bearing an electrical current, lies wholly or in part in a magnetic or electromagnetic field of force, any disturbance in the intensity of the field of force will induce a current in the circuit. While this is generally accepted as true it is not a full statement of the *immediate* actions in the case. When a conductor sweeps through a field of force, or a region in which the ether is under a magnetic or electromagnetic stress, this stress in whole or in part is taken up by the conductor; or, in other words, the conductor itself becomes stressed. This stress in the conductor is its potential difference, or E. M. F. If now the circuit be closed by a conducting path *outside* the coercing field, or through a portion of the field so weak that its E. M. F. is less than the impressed, the stress will be equalized through it and a current will flow. In short, the *immediate* result of a conductor cutting lines of force is the establishment of an E. M. F. The current is secondary, depending upon conditions of conduction. To this extent Lenz's law is misleading. The establishment of an E. M. F. is then wholly independent of the fact that the circuit be open or closed. This latter governs only the *amount* of energy transformed. If a conductor, forming an open circuit, either a straight or bent piece of wire, cut lines of force, energy will always be absorbed, and it can be evaluated by $W=ECt$ could we measure the current and the E. M. F. But in such cases the value of W depends upon the capacity of the conductor. No conductor, not even a straight piece of wire, can be moved in a magnetic field without an absorption of energy equal to its capacity. If the conductor were ideal and yielded to impressed stress without an effect which closely resembles inertia, there would then, of course, be no absorption of energy, or rather the amount would be infinitesimal. The case is analogous to that of a battery on open circuit. Its two poles always show a definite stress or difference of potential.

When a dynamo is started on open circuit it is generally regarded that it absorbs no power, except for mechanical reasons, until the circuit is closed. It really absorbs power to establish an E. M. F. When this reaches its maximum, no further transfer of energy occurs until the circuit be closed.

It may be scarcely necessary to mention an experiment made by the writer, for its results are entirely self-evident. A 110-volt dynamo was separately excited through its shunt coil and run at standard speed. The terminals of the armature circuit were connected to a Kelvin electrostatic voltmeter. The armature circuit was thus open, but the voltmeter recorded 110 volts. The momentary current necessary to establish this E. M. F. was, of course, dependent upon the capacity of the circuit and voltmeter.

Whether the copper of an open secondary circuit of a transformer becomes heated or not, will depend on the conditions mentioned above.

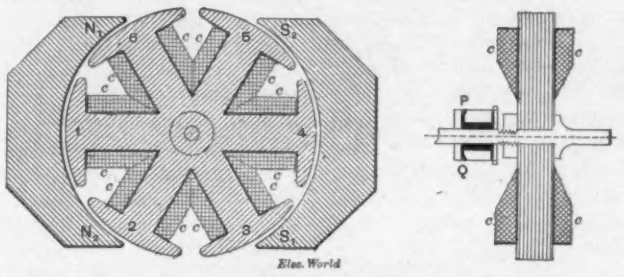
English Honors for American Work.

It may interest Americans to know that the only paper read before the London Institution of Electrical Engineers during the past year which was awarded the Institution premium, was that of Mr. Wilkinson on "Notes on Electric Tramways in the United States and Canada."

Electrodynamic Machinery—XXII.

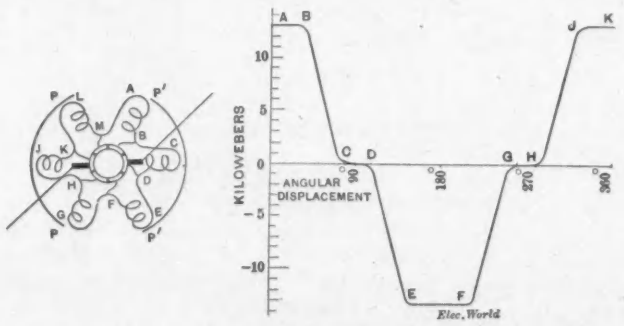
BY EDWIN J. HOUSTON AND A. E. KENNELLY.

107. In order to determine the amount of flux passing through a single projection, let the armature be considered as slowly rotated counter-clock wise. Starting with the core, the magnetic flux passing through it will be found by dividing half the M. M. F. by the reluctance of the air gap over its face, or $\frac{260}{\frac{0.2}{10}}$=13,000 webers. As it moves counter-clock wise towards 2, no appreciable change is effected in the amount of flux it carries until the advancing edge of 2 emerges from beneath the polar face N_2. The flux through 1, rapidly diminishes until before 1 becomes half way between the pole faces N_2 S_1, it is entirely deprived of flux from the coil. When the position 3 is reached, the flux re-enters the coil of 1, but in the opposite direction, and when it passes position 4, the total maximum flux of 13 kilowebers is in the reverse direction. The curve, Fig. 90, commences at 13 kiloweber in the position corresponding to 1, Fig. 87, falls steadily from B to C, and, after a short pause, from C to D where the coil lies midway between the poles, falls again from D to E, until the flux is 13 kilowebers negative, corresponding to the position 4. Continuing at this value to F, it rises to G, correspond ing to the position 5, and then pauses at the zero line, in the gap between the poles, rising finally to J, corresponding to the original position F_1, at K.



FIGS. 87 AND 88.—RADIAL OR POLE ARMATURE. SECTIONS AT RIGHT ANGLES TO AXIS AND THROUGH AXIS.

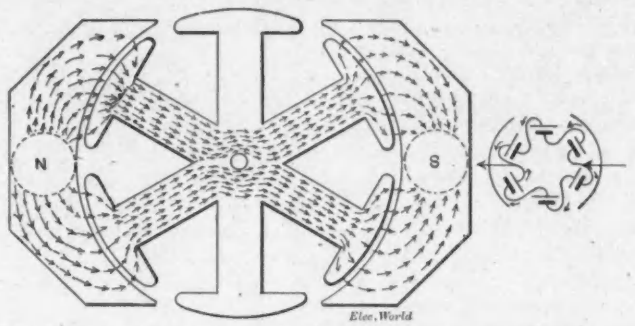
108. The E. M. F. established in any turn of the coil is found by ascertaining, from the speed of rotation, the rapidity with which the flux, threading through the coil, changes in value. If, for example, the armature be driven at a speed of 1,500 revolutions per minute, or 25 revolutions per second, corresponding to the time of 0.04 second per revolution the E. M. F. will evidently be zero at the positions represented by the straight line AB, CD, EF, GH, and JK of Fig. 90, since here, the rate of change in the flux is practically zero and the E. M. F. will be nearly uniform during the periods represented by BC, DE, FG, and HJ, since the rate of change is nearly uniform in one direction or the other during those periods. As shown in Fig. 93, the E. M. F. in the single turn on the projection commencing at the position 1, is zero, from o to b, from b through b' to c, the flux diminishing at the rate of 13,000 webers in 0.00433 second, and, therefore, at the rate of 3,000,000 webers (3 megawebers) per second, and since 100 megawebers per second correspond to an E. M. F. of one volt, the E. M. F. in a single turn being—0.03 volt. Assuming 10 turns of wire on each armature projection, the total E. M. F. will be —0.3 volt at this period, and the ordinate bb represents —0.3 volt in Fig. 93. At $c'd$, corresponding to the position CD, Fig. 90, the E. M. F. is zero, falling again to —0.3 volt from d' to e, corresponding to a change in influx from D to E, Fig. XXXX. After 0.02 second has elapsed, the E. M. F. reverses in direction and becomes positive, tracing the curve ff' gg' hh' jj' k.



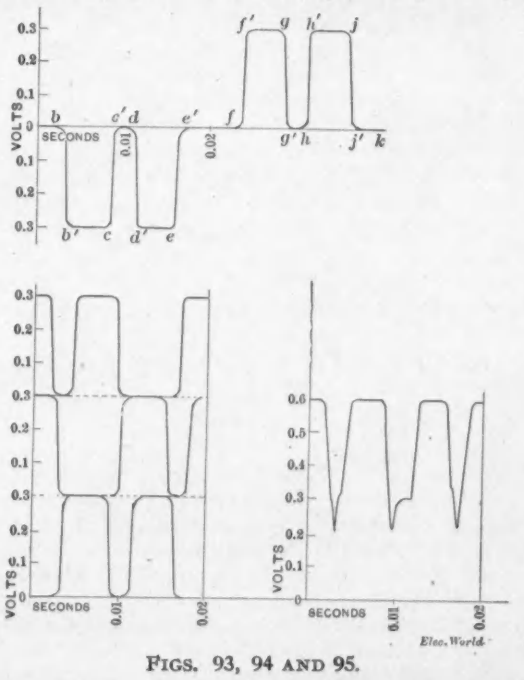
FIGS. 89 AND 90.—DIAGRAMS SHOWING CONNECTIONS OF COIL WITH COMMUTATOR AND FLUX PASSING THROUGH ONE ARMATURE PROJECTION DURING A COMPLETE ROTATION.

By the aid of the commutator, the E. M. F.'s in the coils, as soon as they change their direction, are reversed relatively to the external circuit, and, therefore, preserve their external direction, as can be seen by an examination of Fig. 89.

109. We have thus far traced the E. M. F. as developed in a single polar projection, and as resulting from the variation of flux passing through it. During the time that the E. M. F. is being generated in this coil, a smaller E. M. F. is being generated in the other coils, displaced, however, in time, by portions of a revolution. As shown in Fig. 92, the six coils on the armature have E. M. F.'s developed in them, being connected with the external circuit through the brushes in two parallel series, of 3 series-connected coils. Each coil is, therefore, acting in its circuit for one half of a revolution before it is transferred to the opposite side, and while Fig. 93 represents the E. M. F. generated in any half revolution of one coil, we have to consider the E. M. F.'s coincidently being generated in its next neighbor on either side. This is shown in Fig. 94, where the E. M. F. of all three coils is developed independently on parallel lines one above the other, each E. M. F. being a repetition of that in Fig. 94, but displaced the 1-6 of a complete revolution. Fig. 95 represents the effect of combining or summing these three separately generated E. M. F.'s in the same circuit and it will be seen that the E. M F. pulsates between 0.2 and 0.6 volt.



FIGS. 91 AND 92.—DISTRIBUTION OF FLUX AND E. M. F. AT POSITION SHOWN.



FIGS. 93, 94 AND 95.

110. If the resistance of the wire on each coil be r ohms, then the resistance of the three coils on each side of the armature will be 3 r, and the resistance of these two sides in parallel will be generally 1.5 r, so that, neglecting the resistance of the brushes and brush contacts, the resistance of the armature will be 1.5 r ohms.

The current strength which should be maintained by the generator, when on short circuit, would, therefore, be $\frac{0.6}{1.5\,r}$ amperes, but in reality, the current will not reach this amount, owing,

among other things, to the effect of self-induction in the armature, which, under load, tends to check the pulsations, and consequently renders them more uniform, thus reducing the mean E. M. F.

(To be continued).

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Practical Notes on Dynamo Calculation—XXII.

BY ALFRED E. WIENER.

PART III.—DIMENSIONING OF FIELD MAGNET FRAME.

1. General Construction Rules.

41. Forms of Field Magnets.

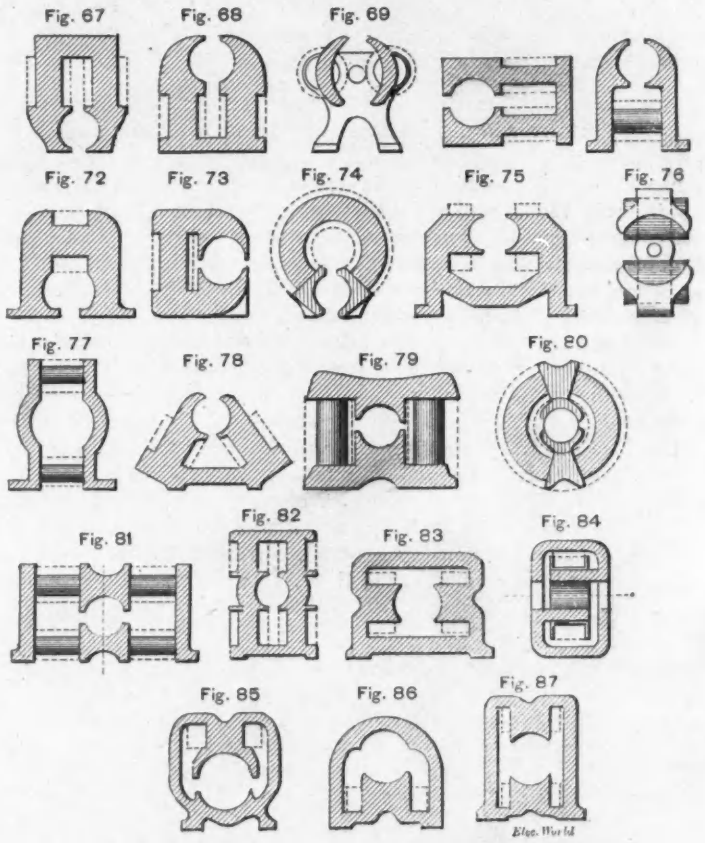
With reference to the type of the field magnet frame modern dynamos may be classified as follows:

I.—Bipolar Machines.

1. Single Horseshoe Type.
   - *a.* Upright single horseshoe type (fig. 67).
   - *b.* Inverted single horseshoe type (fig. 68).
   - *c.* Horizontal single horseshoe type (fig. 69).
   - *d.* Vertical single horseshoe type (fig. 70).
2. Single Magnet Type.
   - *a.* Horizontal single magnet type (figs. 71 and 72).
   - *b.* Vertical single magnet type (fig. 73).
   - *c.* Single magnet ring type (fig. 74).
3. Double Magnet Type.
   - *a.* Horizontal double magnet type (figs. 75 and 77).
   - *b.* Vertical double magnet type (figs. 76 and 79).
   - *c.* Inclined double magnet type (fig. 78)
   - *d.* Double magnet ring type (fig. 80).
4. Double Horseshoe Type.
   - *a.* Horizontal double horseshoe type (fig. 81).
   - *b.* Vertical double horseshoe type (fig. 82).
5. Iron Clad Type.
   - *a.* Horizontal iron clad type (figs. 83 and 84).
   - *b.* Vertical iron clad type.
     - Single magnet vertical iron clad type (figs. 85 and 86).
     - Double magnet vertical iron clad type (fig. 87).

II.—Multipolar Machines.

1. Radial Multipolar Type.
   - *a.* Radial outerpole type (fig. 88).
   - *b.* Radial innerpole type (fig. 89).
2. Tangential Multipolar Type.
   - *a.* Tangential outerpole type (fig. 90).
   - *b.* Tangential innerpole type (fig. 91).
3. Axial Multipolar Type (fig. 92).
4. Radi-tangent Multipolar Type (fig. 93).
5. Single Magnet Multipolar Type.
   - *a.* Axial pole single magnet M. P. type (fig. 94).
   - *b.* Outer-innerpole magnet M. P. type (fig. 95).
6. Double Magnet Multipolar Type (fig. 96).
7. Multipolar Iron Clad Type (fig. 97).
   Horizontal four-polar iron clad type (figs. 98 and 100).
8. Multiple Horseshoe Type (figs. 101 and 102).
9. Quadruple Magnet Type (fig. 103).
10. Four-polar Double Magnet Type (fig. 104).



a. Bipolar types.

The simplest form of field magnet frame is that resembling the shape of a horseshoe. Such a horseshoe-shaped frame may be composed of two magnet-cores joined by a yoke, or may be formed of but one electro-magnet provided with suitably shaped polepieces. The former is called the *single horseshoe type*, the latter the *single magnet type*.

A *single horseshoe frame* may be placed in four different positions with reference to the armature, the two cores either being *above* or *below* the armature, or situated *symmetrically*, one on each side, in a *horizontal* or in a *vertical* position.

The *upright single horseshoe type*, fig. 67, is the realization of the first-named arrangement, having the cores above the armature, and is therefore often called the "*overtype*." This form is now used in the Edison dynamo, built by the General Electric Co., Schenectady, N. Y., in the motors of the C. and C. Electric Co., New York, and is further employed by the E. G. Bernard Company, Troy, N.Y.; by the Detroit Electrical Works, Detroit, Mich. ("King" dynamo); the Commercial Electric Co. (A. D. Adams), Indianapolis, Ind.; the Novelty Electric Co., Philadelphia, Pa.; the Electron Manufacturing Co. ("Perret"), Springfield, Mass.; by Siemens Bros., London, Eng.; Mather & Platt (Hopkinson), Manchester, Eng.; the India-rubber, Gutta-percha & Telegraph Works Co., Silvertown, Eng.; and by Clarke, Muirhead & Co., London.

The *inverted horseshoe type*, fig. 68, having the cores below the armature, is also called the "*under-type*." Of this form are the General Electric Co.'s "Thomson-Houston Motors," the standard motors of the Crocker-Wheeler Electric Co., Ampère, N. J.; further, machines of the Keystone Electric Co., Erie, Pa.; the Belknap Motor Co., Portland, Me.; the Holtzer-Cabot Electric Co., Boston, Mass.; the Card Electric Motor and Dynamo Co., Cincinnati, O.; the La Roche Electrical Works, Philadelphia, Pa.; the Excelsior Electric Co., New York; the Zucker & Levett Chemical Co., New York (American "Giant" Dynamo); the Knapp Electric and Novelty Co., New York; the Aurora Electric Co., Philadelphia, Pa.; the Detroit Motor Co., Detroit, Mich.; the National Electric Manufacturing Co., Eau Claire, Wis.; Patterson & Cooper (Esson), London; Johnson & Phillips (Kapp), London; Siemens & Halske, Berlin, Germany; and Ganz & Co., Budapest, Austria.

Machines of the *horizontal single horseshoe type*, fig. 69, in which the centre lines of the two magnet-cores and the axis of the armature lie in the same horizontal plane, are built by the Jenney Electric Co., New Bedford, Mass. ("Star" Dynamo), by the Great Western Manufacturing Co. (Bain), Chicago, Ill., and by O. L. Kummer & Co., Dresden, Germany.

The *vertical single horseshoe type*, fig. 70, finally, having the axes of magnet-cores and armature in one vertical plane, is employed by the Excelsior Electric Co. (Hochhausen), New York, and by the Donaldson-Macrae Electric Co., Baltimore, Md.

Single core horseshoe frames may be designed by placing the magnet either in a *horizontal* or in a *vertical* position, or by joining two polepieces of suitable shape by a magnet of circular form. The types thus obtained are the *horizontal single magnet type*, the *vertical single magnet type*, and the *single magnet ring type*.

In the *horizontal single magnet type*, figs. 71 and 72 respectively, the armature may either be situated *above* or *below* the core. Machines of the former type (fig. 71) are built by the Jenney Electric Motor Co., Indianapolis, Ind.; the Porter Standard Motor Co., New York; the Fort Wayne Electric Co., Fort Wayne, Ind.; the United States Electr. Co., New York; the Holtzer-Cabot Electr. Co., Boston; the Card Electric Motor and

Dynamo Co., Cincinnati, O.; the Simpson Electr. Mfg. Co., the Chicago Electric Motor Co., Chicago; the Bernstein Electric Co., Boston; and by the Premier Electric Co., Brooklyn. The latter type, fig. 72, is employed by the Electron Mfg. Co., Springfield, Mass.; and by the Riker Electric Motor Co., Brooklyn.

The *vertical single magnet type*, fig. 73, is used by the "D. & D." Electr. Mfg. Co., Minneapolis, Minn.; the Packard Electr. Co., Warren, O.; the Boston Fan Motor Co., Boston; the Elbridge Electr. Mfg. Co., Elbridge, N. Y.; the Woodside Electr. Works (Rankin-Kennedy) Glasgow, Scotland; by Greenwood & Batley, Leeds, England; and by Goolden & Trotter (Atkinson), England.

Fig. 74 shows the *single magnet ring type*, which is employed by the Mather Electric Co., Manchester, Conn.

Two magnets, instead of forming the limbs of a horseshoe, can also be set in line with each other, one on each side of the armature, or may be arranged so as to be symmetrical to the armature, but with like poles pointing to the same direction, instead of forming a single magnetic circuit with *salient* poles; the form will then constitute a double circuit with *consequent* poles in the yokes joining the respective ends of the magnet cores. In both of these cases the cores may be put in a horizontal or vertical position, and in consequence we obtain two *horizontal double magnet types*, figs. 75 and 77, and two *vertical double magnet types*, figs. 76 and 79.

The *salient pole horizontal double magnet type*, fig. 75, is employed by Naglo Bros., Berlin, and by Fein & Co., Stuttgart, Germany; and the *salient pole vertical double magnet type*, fig. 76, by the Edison Manufacturing Co., New York.

The *consequent pole horizontal double magnet type*, fig. 77, is used n the Feldkamp Motor, built by the Electrical Press Co., Newark, N. J., and in the Fan motor of the De Mott Motor and Battery Co.; and the *consequent pole vertical double magnet type*, fig. 79, by the Columbia Electric Co., Worcester, Mass.; the Keystone Electric Co., Erie, Pa.; the Akron Elec. Mfg. Co., Akron, O.; the Mather Elec. Co., Manchester, Conn.; the Duplex Elec. Co., Corry, Pa.; the General Elec. Traction Co. (Snell), England; Mather & Platt (Hopkinson), Manchester, England; Immish & Co., England; Oerlikon Works (Brown), Zurich, Switzerland; and Helios Co., Cologne.

If in the latter form magnets are made of circular shape, the *double magnet ring type*, fig. 80, is obtained, which is built by the "C. & C." Electric Co., New York, and which has been used in the Griscom Motor of the Electro-dynamic Co., Philadelphia.

The *inclined double-magnet type*, illustrated in fig. 78, forms the connecting link between the double magnet and the single horseshoe types; it is employed by the Baxter Electrical Mfg. Co., Baltimore, Md.; by Fein & Co., Stuttgart; and by Schorer, in Darmstadt.

(To be continued.)

The National School of Electricity.

In accordance with the policy of THE ELECTRICAL WORLD to present in its columns all sides of a question of public interest, we print below the result of inquiries among those connected with the National School of Electricity, concerning recent criticisms directed at the management of that enterpise:

PROF. J. P. BARRETT, President of the School:—"If you will stop and consider a moment, you will see that the conduct of the school has been in strict accordance with all our promises and authorized representations. In the first place, we have never claimed to be a philanthropic enterprise, pure and simple. We are philanthropic to the extent of giving our students the benefit of carefully-prepared and carefully-taught lessons at the rate of thirty-nine cents a lesson, and this figure represents practically the actual cost. As to the character of the lessons, if the leaves themselves are not ample, you can determine by writing the different members of the Faculty just how they are prepared and revised. No member of the Faculty joined the school on our misrepesentation. We told each member what we intended to do, nothing less, nothing more, and if some of them have seen fit to express dissatisfaction, they have done it without any justification in fact. So far as the conduct of the school is concerned, we have redeemed every pledge, and will go straight forward. It is true that some members of the Faculty joined simply as honorary members, and still remain so. Others joined with the understanding that they would have practical detail work to do in perfecting the educational features of the establishment. Up to date they have lived up to their conception of what was necessary in the preparation of lessons, and express themselves as pleased with the results attained. The school is flourishing beyond our best hopes. We now have fifty-three classes with an average membership of thirty-one, and new ones are being started right along. And that reminds me that the best proof of our success is that the majority of our classes have been established by students who have actually taken lessons. So you see the people think we are all right. But if you want proof, and I suppose you do, just investigate for yourself. Ask the "active" members of the Faculty, ask the students or their instructors. Perhaps their opinions will be worth reading."

PROF. D. C. JACKSON, of the University of Wisconsin:—"Before my name was placed on the list of the Faculty of the school, the objects of the school, and the duties of the Faculty, were thoroughly explained to me. The objects seemed to be praiseworthy and honorable, and as far as I know they have been properly carried out according to the original plan. It was the intention, as explained to me, to have members of the Faculty write lessons in the various courses of the school, and the proof-sheets of these lessons were proposed to be sent to each member of the Faculty for his revision and correction. This plan has been carried out, and has apparently proved satisfactory. A number of proof-sheets of lessons written by others have been sent to me for examination and revision, and I have received corrected proof-sheets from other members of the Faculty covering the various lessons written by me. The lessons may therefore be accepted as having been examined and revised by at least a considerable number of the Faculty. It was never proposed to me that the members of the Faculty should do any actual instruction, and no case has been brought to my attention where such a suggestion was made by the managers of the school. It is absurd to expect that men tied down by university and business duties should be able to travel about the country to teach the classes, however much support they are otherwise willing to give to the chool. As I have uuderstood the matter, it has always been the intention to have a local instructor for each class, and this arrangement has be carried out. Several classes have been organized at points where members of the Faculty reside, and these members have usually participated in the organization and sometimes in the teaching of the classes of their own volition. The methods outlined for the school are ideal ones for giving instruction to the large number of people who hunger for knowledge, and who especially desire some knowledge regarding electricity and the way in which it is used. That people who wish to learn for the sake of learning are very numerous is shown by the remarkable success of Chautauqua "literary circles," which have proved a source of literary information and pleasure to many thousands of people. For such people the classes of the National School of Electricity are "electric circles," led by instructors who are chosen because of special knowledge and aptitude. The methods outlined also seem to me to be very good for the purpose of giving professional men or electrical artisans either a general or a special knowledge of the electrical industries. For instance, the course in electro-therapeutics, which the managers of the school have proposed to carry on under the general direction of Dr. Herdman, fills a place where a decided want is felt. The course which is intended to give instruction in the best methods of handling electric railway apparatus, should also be of much service to the motormen, linemen and repairmen of electric railways, especially if such classes are led by a instructor who has knowledge of the requirements of electric railway operation. Proper electrical and mechanical instruction of the electric railway employees should be as advantageous to the railway companies as to the employees, and I understand the course has been planned with the assistance of the superintendents or electricians of two or more large roads. As I am located a hundred or more miles from points where classes are aikely to be demanded, I have seen comparatively little of the class work, but the activity of Professors Carhart, Shepardson and Thomas, who are near to class centres, gives me confidence that the methods are working out all right. There are others besides myself, who support the school, who would have nothing to do with the plan, did they not believe it to be useful."

PROF. GEO. D. SHEPARDSON, of the University of Minnesota:—"I am preparing the weekly lessons for the special course for street railway employees, being engaged at present with the preparation of Lesson XXIII. Proofs of these lessons are sent to other members of the honorary Faculty and each week I receive copies returned with suggestions and criticisms by various professors. The lessons are revised in accordance with these suggestions and are then returned to Chicago, where permanent plates are made for printing the copies which are sent out to the classes. Each week I also receive copies of the lessons for the general course, prepared by Prof. Jackson, upon which I am invited to make criticisms. Regarding

the work of the school, I have assisted in the organization of classes in Minneapolis, St. Paul and Cincinnati. At each of the meetings for organization of classes in these cities the methods and purposes of the school were fairly presented. At each meeting I attended, it was distinctly emphasized that the school did not claim or expect to produce trained electricians, but that it did intend to give the students a thorough grounding in the elements of the subject and open the way for them to grow into a better knowledge. In no case were the people led to believe they could become famous inventors or engineers because of the knowledge imparted by the lessons. Such statements may have been made in some places by enthusiastic local speakers, but I do not believe they have been made by parties officially connected with the school. As to the work done by the classes, I hear from the classes in Minneapolis and St. Paul that the students are extremely well pleased and more than satisfied. I have learned directly from the employers of some of these men that as one result of their study they do much better work in the shop and some have become efficient workmen who have been in imminent danger of discharge for incompetency.

Prof. Henry S. Carhart, of the University of Michigan:—"I see no reason to withdraw my confidence from the managers of the National School of Electricity. Very likely they have made some mistakes and their plans need some revision after the experience thus far obtained. But there is every reason to believe that they intend and are prepared to give the best possible satisfaction to all those who have joined the classes in different parts of the country. The object and purposes of the school are good. It is not expected that one or two courses of lessons can make electrical engineers of young men who have not the necessary technical training, but a good foundation of practical principles can be taught which will be of great service. The classes in electro-therapeutics promise the best results. Respecting my own share of the work, I have read the proof of all the lessons up to date and have made many suggestions. I have also interested myself in procuring suitable teachers for classes in Detroit, Toledo and Philadelphia, and the men whom I have nominated have all been appointed. Many are thoroughly competent to give instruction, not only in theory, but in the practical applications of electricity. Two of them have had wide experience in electrical engineering and electrical design. The school is handicapped with all the difficulties besetting a new enterprise, but there is no foundation, so far as I can see, for the attacks made upon it in certain quarters."

Prof. W. J. Herdman, of the University of Michigan: "I have been convinced from the time the plan of this school was first promulgated that, if it was properly managed, it would occupy a very wide field of usefulness. I was confident that it could be made useful, among other ways, in meeting the needs of a great many professional men, who would find electricity of much service to them in their work if they knew how to use it intelligently. The great obstacle in the way of a more general use of electricity as a curative agent has been a want of knowledge on the part of physicians, surgeons and dentists of the fundamental principles of electric action. Many of these professional men have for years recognized the advantages which would accrue to them from this information, but in the midst of their professional duties they could neither take the time to go away from home in search of it, nor could they find many schools where the instruction was adapted to meet their peculiar needs. The plan of the National School is such as to provide in a most satisfactory manner for meeting the requirements in this direction of such professional men. Already there are seven classes in various parts of the country, numbering in all about one hundred and forty physicians, engaged in pursuing the course arranged by the National School. This course for physicians consists of (1) lessons in electro-physics, (2) lessons in the fundamental principles of electro-therapeutics, and (3) lectures demonstrating the application of electricity to special fields of practice in medicine and surgery. The course as outlined is quite comprehensive and thorough, and, so far as I can learn, has given entire satisfaction to all who are pursuing it. The great advantage to the physician of this method of instruction is, that it furnishes him an opportunity to gain a knowledge of electricity that will be helpful to him in prosecuting his professional work, without any interruption in his business, so that he incurs neither loss of time nor means. The eagerness with which physicians have sought this opportunity furnished by the National School is sufficient proof of the demand there is for it. As a member of the Faculty, all lessons in process of preparation are sent to me with the request that they be examined and criticised and returned to the central office for rearrangement. I am directly responsible for the educational part of the electro-therapeutic work, so far as the general supervision of it is concerned. I have seen nothing during my connection with the school that caused me to doubt the honesty or efficiency of its managers. They are men of character, accustomed to affairs comprehensive in their nature, which they have always conducted to a successful issue. I have found them redeeming their promises in every instance, and have yet to hear a complaint from any one connected with the various branches they have organized to the effect that they have not complied with the terms of their agreements."

Prof. M. O'Dea, of the University of Notre Dame: "To indorse the published instruction matter of the school is somewhat similar to endorsing the maxims of Euclid. The lessons consist of standard electrical physics, similar and equal to those found in the latest text books. To this are added simple and precise details of applications and operations, with shop terms and examples of the best shop practice. Keeping in mind the class of students for whom they are prepared, the lessons are undoubtedly superior to any text book that has yet been published. This, I think, will be most readily acknowledged by those who, like myself, twelve or fifteen years ago, were earnestly searching for similar matter in the text books and in the first numbers of The Operator and Electrical World. I have had correspondence and interviews with various people who are using the lessons and all expressed satisfaction and praise." Another member of the honorary Faculty states that he is not well enough posted in regard to the worth of the school or its methods to say anything, and that he has requested to have his name withdrawn, though, he adds, he does not care to advertise the fact of his withdrawal.

A list of the school's instructors furnished to us is printed below. These gentlemen are stated to be, in nearly every case, graduates of some technical institution, but in the hurry of preparing the list it was impossible to ascertain the name of the Alma Mater in every case:

Chicago: H. G. Brownell, Rose Polytechnic; Locke Etheredge, Cornell University; Glen Wray, Cornell University; C. E. Sturtevant, Institute of Technology; J. J. Green, Ohio State University; George Foster.—St. Louis: A. J. O'Reilly, City Electrician.—Joliet, Ill.: George B. McClelland.—Belvidere, Ill.: J. A. Parkhurst, Rose Polytechnic.—Aurora, Ill.: E. H. Richardson, Aurora Electric Co.—Minneapolis and St. Paul; George B. Morse, Pillsbury Co.—Fort Wayne, Ind.; A. L. Hadley, Thomas Duncan, Fort Wayne Electrical Corporation.—Elkhart, Ind.: H. G. Brownell, Rose Polytechnic.—Toledo, Ohio: H. P. Doge.—Detroit, Mich.: H. R. King, University of Michigan, Electrical Engineer.—Columbus, Ohio: James E. Boyd, N. H. Brown, Instructors in Ohio State University.—Cincinnati, Ohio: Thomas J. Creaghead, Electrical Engineer; Prof. Thomas French, Professor of Physics, Cincinnati University.—New York and Stamford, Conn.: Max Osterberg, Columbia College.—Schenectady, N. Y.: Alfred E. Wiener, of the General Electric Co.—Boston and Fall River, Mass.: John W. Sears, Jr., Massachusetts Electric Supply Co.—Jersey City, Newark and Paterson, N. J.: Newton Harrison.—Plainfield, N. J.: A. J. Clemens.—Wissahickon, Pa.: S. A. Tatnall, of Queen & Co., Philadelphia, Pa.—Philadelphia, Pa.: Elmer G. Willyoung, of Falkenau Engineering Co., Philadelphia, Pa.

Fly-Wheel Accidents in Power Houses.

To the Editor of The Electrical World:

Sir—Mr. M. P. Ryder, in his letter printed in The Electrical World of December 29, 1894, is correct in saying that the automatic cutout, suggested by me in your issue of December 8, should be in series with the armatures. This was intended, but at the moment of writing, I overlooked the fact that while if connected to both terminals of the armature it would be in series when the dynamo was generating, it would be in parallel when running as a motor. I did not lose sight of the fact that the polarity of the dynamo would not be reversed. Had I taken time to read over what I had written, or noticed that it had been published, I should have noticed and corrected the mistake myself.

Somerville, N. J. A. H. Burnett.

Static Electricity and Printing.

To the Editor of The Electrical World:

Sir:—I seek information on a subject which I feel sure interests many readers of your most valuable paper, viz.: the presence of static electricity in paper during the process of printing on cylinder presses, and a means of getting rid of the same. I trust that yourself or some of your readers can suggest a way of partially eliminating, at least, that which is the cause of so much annoyance and loss to printers.

New York, N. Y. S. Wallace.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

Note.—The object of this department is to give a digest of the principal technical articles on electrical subjects appearing in American and foreign periodicals. The abstracts will contain, briefly, the nature of the article, its object, and the most important data or conclusions, as far as the limited space will admit. Abstracts made by the authors, editors or publishers are solicited and should be sent to the Philadelphia office of THE ELECTRICAL WORLD, 927 Chestnut street. They should be forwarded so as to be received at least as early as the journal in which the original articles appear; they should not be longer than the importance of the subject warrants, and must comply with the general outline given above, the compiler reserving the right to edit or reject them. Such abstracts may be sent in the English, French or German languages. It will be to the advantage of all concerned if editors of non-electrical journals, or of such electrical journals as are not regularly abstracted, will send the compiler a copy, specially marked, in which any important electrical article appears.

DYNAMOS, MOTORS AND TRANSFORMERS.

Influence of Current Curves.—Referring to the recent paper of Dr. Duncan, read at the May meeting of the American Institute of Electrical Engineers, Mr. Kolben, of Oerlikon, in a brief paper discusses the subject of the influence of the form of the curve of the alternators on the running of motors, his paper being published in the "Elek. Zeit.," Dec. 20. He gives the conclusions arrived at from observations with several hundred alternating current motors. A correctly constructed single or multiphase motor, he claims, is entirely independent of the construction of the generator and of its current form, that the motor will always run well and that any differences in the current consumption at starting, at no load and at full load, as also the watt consumption and the power factor, are practically negligible; he gives the results in tabulated form for a motor run with two different alternators, the results showing that the curve form has practically no influence on the running of the motor. A matter of much greater importance, however, is the influence of the motor on the curve form of the generator; for high voltages, curves with points whose maximum values are double the mean should be avoided; in certain cases a generator having a very good curve may have it changed to a very dangerous one by the motor; several curves of this kind are shown for a 300 hp, three phase generator loaded with a 200 hp non-synchronous motor which drove a factory together with a well regulated steam engine, the generator being driven by a turbine (the curve is very jagged and has the character of numerous saw teeth); besides the resulting increased iron losses in the generator, transformer and motor, the maximum voltage is very high, being in this case 13,000 volts, the self induction of the line, and the impedance factor will be appreciably increased, and the charging current of the line will become greater, causing an increase in the line loss.

Dynamo Without Iron.—A paper by Prof. Pietzker is published at considerable length in the "Elek. Zeit.," Dec. 20. He discusses theoretically the construction of a dynamo without iron, consisting of two armatures, one revolving inside of the other. The system is the same as that described in the Digest. Aug. 11. He concludes that the weight would thereby be reduced to ¼ or even ⅛ of that of a dynamo with iron; the volume and the cost would also be reduced and the machine would not have the objections which in the present forms are caused by the magnetization of the armatures; one objection is that the external resistance cannot be increased beyond a certain value as the machine would then die out. (The machine has not been constructed and the article appears to be of no practical interest.)

Starting Motors.—In a communication to the "Elek. Zeit.," Dec. 20, Mr. Egger describes a system of especial use for smaller motors. When at rest the magnets are short circuited by the starting resistance and the armature, and therefore when stopped there is no spark due to the field magnet circuit; at starting there is no resistance in the field circuit, but it is all in the armature circuit, under which conditions the motor will run at the lowest speed; for full speed the total resistance is in the field and none at all in the armature circuit. He discusses also the objections raised by Mr. Manges to his proposed system described in the Digest, Sept. 15.

Transformer Chambers.—A report of another conference of the Board of Trade is published in the Lond. "Elec.," "Elec. Rev." and "Elec. Eng.," Dec. 21; it is also discussed editorially in the former.

LIGHTS AND LIGHTING.

Projectors.—The second part of the long serial by Messrs. Tchikoleff, Klasson & Tuiin, is begun in "L'Eclairage Elec.," Dec. 8. They attack very severely the recent publication of Mr. Blondel, stating that his results are absurd and contrary to what really exists, etc.; to this Mr. Blondel replies briefly in a foot-note stating that they do not appear to have given his publication sufficient attention nor that they have considered the recent publications of other authors, as, for instance, those of Mr. Nerz; he states that the experimental data agree with his statements. In the present article the authors treat of the visibility of objects illuminated by electric projectors, and the solution of some practical problems concerning lighting by projectors; they give a large table containing practical data, under various circumstances, for lighting and for seeing objets; this data, if reliable, would probably be of use to the interested in this subject. Among other things they state that for parabolic projectors, with short focal distances, the horizontal position of the carbons is indisputably the best; even for the Mangin projectors recent measurements have shown that the horizontal position is the best; in view of which fact the French government has recently ordered 100 of them to be fitted up in this way; they consider that the advantage of parabolic reflectors over the Mangin mirrors of the same dimensions has been demonstrated; with projectors 90 cm in diameter, large white buildings were visible at a distance of 9 km by a person stationed at the projector; large vessels were visible at a distance of 6,000 metres, especially when they have sails or when smoke issues from the chimneys, but it is difficult to see black vessels at a distance of 5,000 or even 4,000 metres, while small boats can be seen at 2,000; but all these figures depend on the state of the atmosphere and other conditions; with field glasses, persons can be seen at a distance of 3,200; all these figures refer to the most transparent condition of the air and apply almost equally well to the Mangin and the parabolic reflectors; with projectors 60 cm. in diameter, the visibility diminishes from 10 to 15 per cent. The article appears to be well worth the attention of those interested and does not admit of being abstracted.

Incandescent Lamp.—The long serial by Mr. Bainville, mentioned before in these columns, is concluded in "L'Elec.," Dec. 15. It will be remembered that a translation of this series is being published by the Lond. "Elec. Rev."

Scott Flashing Lamp.—The Lond. "Elec. Rev.," Dec. 21, states that after a trial for over two years the Admiralty has decided that this lamp is not suitable for naval service.

Explosion of an Incandescent Lamp.—In "La Nature," Dec. 22, Mr. Bleunard states that a workman recently held an incandescent lamp near a belt, when suddenly it exploded; the explanation of it is that the lamp forms a Leyden jar and was charged by the static electricity generated by the belt, the charge increasing to such an extent that it pierced the glass, after which an explosion naturally followed; the experiment can readily be repeated with an influence machine.

POWER AND HEAT.

Transmission from Coal Fields.—A paper by Messrs. Thwaite & Swinburne from the "Nineteenth Century," of December, is abstracted briefly in the Lond. "Elec. Eng.," Dec. 21. The project is to supply electric power from central stations built in the centre of the coal fields and transmit it to the great industrial centres, including London, where transforming and storage stations could be erected; the electric energy could be sold to the different distributing companies at a little over two cents per kw hour and to the small factory owner for about $25 per 3,000 working hours for one hp; in London this costs at present about twice as much; the system enables valuable chemical constituents to be recovered from the coal, which at present cannot be done in the small steam power plants; one of these constituents is sulphate of ammonia; it is estimated that one hp hour can be obtained for ¾ pound of coal, the average consumption at present being 5 pounds; the loss in transmission from the coal fields to London is about 33 per cent.; for transmitting 10,000 hp, three bare conductors for the positive and three for the negative would be used and run on oil insulators; 30,000 volts are to be used; the London stations can then sell their current from 6 to 8 cents per kw hour instead of the present amount, which is about double this.

Utilization of Wind Power.—Mr. Kennedy in the Lond. "Elec. Rev.," Dec. 21, calls attention to the difficulty inherent to the fact that the windmill runs at very variable speeds, while the dynamo in charging a storage battery requires a nearly constant speed; he therefore proposes as the only solution to store the wind itself in the form of compressed air,

a scheme which he thinks is practicable; the windmill of the horizontal type would compress air into steel reservoirs up to a pressure of 10 atmospheres; this air would then be used to run an engine driving a dynamo, with or without accumulators; the plant would cost considerable, but the working expenses would be low. Where an elevated reservoir for water can be readily formed, the windmill may be used to pump water into this reservoir, which in turn would drive a turbine and dynamo, but in this case frost might interfere.

Windmill Installation.—"L'Energie Elec.," Dec. 16, publishes an illustrated description of a lighting installation in Paris. The description contains but little data; the windmill has 10 vanes and the diameter is about 17 feet. It will develop about 2 hp with a wind of 5 to 7 metres per second and 8 to 9 hp with a wind of 12 to 15 metres per second. The illustration includes the windmill and the automatic electric cut out.

Niagara Power Works.—A photograph of the interior and exterior views of the power house is published in the Lond. "Engineering," Dec. 21.

Operating Machine Tools by Electricity.—The "Eng. Mag." for Jan. contains a paper by Mr. Richmond including a number of illustrations of shops and tools. He states that experiments on a variety of tools have shown that 1 hp applied directly is sufficient to remove about 40 pounds of cast iron, 33 pounds of wrought iron, and 23 pounds of steel. He gives a table which contains the total hp, and that required to drive the shafting in 10 large establishments in this country, from which it appears that the power lost in the shafting varies from 15 to 80 per cent., the average being 38.6; but these conclusions are only very general. He discusses the driving of tools by individual motors; with light travelling cranes running over all the tools and with direct driven machines in which the variations of the cut can be followed up with changes of speed, more work could be gotten out of a machine tool "than had ever been dreamed of." He admits that there are many applications of the direct driven machine tool which fully justified the claims, but for an ordinary machine shop he states that "in the present state of the art it can hardly be seriously claimed that such a shop could be run with a less expenditure of motive power than one fitted up with reasonable efficient transmission." As the coupled motor must furnish the maximum power required, one question is, whether the safety fuse can be depended on to the same extent as the slipping of the belt, to avoid disastrous results of carelessness or inattention. He gives as the average efficiency of such motors 60 to 70 per cent., because they are usually run below their rated capacity; and for the generator 85 to 90 per cent., making a total of about 50 to 70 per cent.; on account of the time required to take care of the motors he believes that in point of economy the advantage remains with shaft transmission; the fact that the motor stops when no work is done he thinks is not as important a fact as is usually believed, as the majority of the tools in an ordinary shop run with short intermissions, but for larger tools subject to intermittent use, and distributed over a large area, the advantage may be in favor of electric transmission; besides, there is the advantage of a clear headway. He describes such an installation in the shop of the De La Vergne refrigerating machine company, including a full page table giving the results of trials extending over five weeks, including the time run by each motor, the machine driven by it and the average hp as recorded by a wattmeter; the average electric hp was 9.63, while the indicated was 23.98; he suggests using a smaller plant in connection with storage batteries. An equipment of direct coupled motors is undoubtedly more expensive than shaft transmission. The number of men employed per hp varies very much in different shops, the average of 10 shops being about 3 men; he deduces the conclusion that 1 per cent. increase in the efficiency of the tool would compensate a doubling up of the total hp now used in these 10 shops, and "hence the money value in any possible difference in the cost of transmission sinks into insignificance before only a small percentage of increase in the efficiency of the tool;" the principle proposition is, does direct driving increase the efficiency of the tool, if so, to what extent?

Water Wheels.—"Industry" for January, in an article on Constructive Engineering on the Pacific Coast, describes and illustrates a Pelton water wheel in connection with dynamos.

Mine Hoist.—A mine hoist of 125-hp constructed by the General Electric Co., is illustrated and briefly described in "Industry" for January.

Selection of Motive Power.—The "Eng. Mag." for January contains the first paper of a series on this subject, by Dr. Emery, parts of which may be of interest to the electrician.

TRACTION.

Accumulator Traction.—The discussion of Mr. Gibbings' paper (see Digest, Jan. 5,) is published in the Lond. "Elec. Eng.," Dec. 21. Mr. Manville discussed the destructor plant; regarding accumulator traction he stated that he was running the only system in use in that country, and that the company has never yet been able to make both ends meet, the cost of running by this system being under most circumstances prohibitive; this was not due to the depreciation of the accumulator plates, which cost 3.5 cents per car mile, whereas the total cost of running exceeded 18 cents; by the trolley system it would be only 9 cents; adding the renewal of the plates to this, there still remains the balance of about 6 cents, which was absorbed in the extra cost of labor in handling, cleaning, etc., of the accumulators and the extra depreciation of the car bodies due to the fumes from the accumulators; even if the accumulator plates cost nothing, the cost of handling them and the cost of repairing the damage they did would prohibitively raise the cost above that of other systems; they found that they used about 1-kw hour produced at the generating station for every car mile running, so that the energy cost less than half the expense of handling the accumulators and repairing the cars. He favors the use of accumulators at the station where there is no extra expense in handling them and none for car repairs; such a system was recently installed on the Isle of Man. He suggests that an alternating current motor with a continuous current generator attached would make an almost ideal motor generator when run in connection with accumulators. Mr. Ferranti stated that even if the batteries could be charged by current cheaply obtained from the lighting station, it must be remembered that the latter plant could be relied on only for a short number of hours out of the 24, as a sufficient margin must be allowed for the continuous heavy load for a few days in the winter of every year; if it were not for this difficulty he believes that batteries for assisting the ordinary supply stations would have been largely introduced. Mr. Hesketh stated that on one of the Continental lines, on which accumulator traction was used, there were about 100 men in the station charging and attending the batteries for only 20 cars.

In a communication to the Lond. "Elec. Rev.," Dec. 21, Mr. Epstein replies to some criticisms of that journal regarding the recent paper of Mr. Gibbings. Referring to the editorial criticism he states that the premises, the facts, and, therefore, the conclusions are utterly wrong; regarding the depreciation of certain accumulators he states that it is covered by a small fraction of a penny (2 cents) per car mile run; the fact that several lines were financially unsatisfactory, he states was due to circumstances with which the batteries had absolutely nothing to do; traction by means of accumulators if properly managed is not dearer, but in many cases cheaper than by any system of long distance transmission; regarding the payment for the capital sunk in batteries, he states that this is true also for that sunk in other electrical systems, and as the first outlay in accumulator traction is considerably less, the balance is in its favor; he states that the batteries can be charged as rapidly and as economically as they are discharged, also that two sets per car are sufficient, besides a reserve of one set for two cars; regarding the additional weight he states that it is not quite three-quarters of a ton more for a 10 ton car for 52 passengers, or about 8 per cent. of the total weight.

Traction.—The discussion of the recent Institution paper is continued in the Lond. "Elec. Rev.," Dec. 21 (see Digest, Dec. 29). It contains very little of technical interest; Mr. Lea discussed the subject of rack railways; Mr. Wain stated that the failure of storage batteries in England for traction purposes was due to a variety of causes and not necessarily to the batteries themselves; he has tried accumulators of a number of different types, and is about to try the Theryc-Oblasser cells on the Birmingham road; the side trolley system at South Staffordshire was very satisfactory from both a pecuniary point of view and to those who objected to overhead wires from the aesthetical standpoint.

Alpine Road.—According to the Lond. "Elec. Eng.," Dec. 21, the Swiss Council of State, by a large majority, has granted a concession for the construction of the mountain railway to the top of the snow-clad Alp, Jungfrau (described in the Digest, March 17); the assent of the National Council is assured, and it is stated that the capital for this bold undertaking has already been found chiefly in England and America.

The "Elec. Tech.," Dec. 15, states that there is a project, which will probably be carried out, for the construction of an electric road in the heart of the Alps, extending from the town of Zermatt to the Gornergrat (a favorite point, from which one of the finest views in the Alps can be obtained); it will be a rack and pinion line 6 miles long and is to cost about $700,000, the highest point reached being about 10,000 feet above the sea.

Surface Contact System.—In a report in "L'Eclairage Elec.," Dec. 8, Mr. Wuilleumier states that in his system, which is in use at Lyons, France (described in the Digest, Oct. 13 and 20), a distribution box complete costs about $64, and that in general the cost of his system is the same as that for the overhead wire, giving the figure $4,200 per km (or about $7,000 per mile) for an installation in Paris.

South Staffordshire Railway.—According to the Lond. "Elec. Eng.," Dec. 21, the cars on this line have stopped running and it is uncertain whether the service will be renewed (it will be remembered that on this line a side trolley system was used); it is stated that the stoppage is due to a failure of the tramway company to pay the contractors for running the cars.

Coupled Wheels on Cars.—The question whether the wheels of electric cars should be coupled or not, is briefly discussed in the Lond. "Elec.," Dec. 21; with coupled wheels the traction friction and stiffness are increased considerably; if one motor starts racing, all the trains and tractive effort are thrown on the other motor, which then has all the work to do and therefore starts racing too; but if the motors are coupled the chances of a general slipping are reduced very considerably.

Light Railways.—A report concerning some railways in Belgium is published in the Lond. "Elec.," Dec. 21.

Flying Machine.—A lecture by Prof. Wollner on his flying machine is abstracted in the "Elec. Tech.," Dec. 15. He states that the reported failure of the machine was premature and that his experiments had to be discontinued temporarily on account of other reasons; from the experience which he has had he is convinced that the solution of the problem is possible.

New York Rapid Transit Railway.—The "Eng. News," Dec. 27, publishes in full the report of the chief engineer, Parsons. No mention is made of any of the electrical features. Among the objections to the provisionally adopted plans are that the cross section is entirely too small, as it is necessary to provide more accommodation for inspectors and trackmen; a width of 50 ft. is given as the minimum; the standard car of the Manhattan Railway has been adopted and requires a clear height of tunnel of 13 feet; the provisional plan did not consider the question of sewers; the only practical method by which such a road can be constructed would be by open cut; he does not approve of the double deck plan and suggests the construction of express lines under other streets to City Hall; he suggests, however, an alternative plan, of which a good illustration is given, for a two track road in a masonry tunnel and two single circular tunnels of iron, beneath it, for the express line; the construction of the line involves the tearing up of only half of the street at a time; estimates are given of the cost of each of the various sections of the lines as also for the alternative plan.

Accumulator Traction.—According to the "Eng. News," Dec. 27, cars are now being equipped with the Waddell-Entz alkaline storage battery for use at Hagen, Berlin and Vienna, at which latter place they are to run on a regular steam railway between ordinary trains on which, therefore, high speeds must be obtained.

The first part of Mr. Gibbing's paper (see above) is published in the "St. Ry. Gaz.," Dec. 29, in which it is also discussed editorially.

Power Plant of the Steinway Ry.—An illustrated description of the power house is published in the "St. Ry. Gaz.," Dec. 29; the article includes the results of a test in detail made at the power house, most of the data referring to the boilers and engines; there was a total average hp of the engine of 425, the average electrical hp was 340.6, the ratio of the electrical to the indicated hp. was 80 per cent., 2.77 pounds of coal were used per electrical hp per hour; the test lasted 6 hours.

Traction.—A part of the discussion of the recent Institution (London) paper, which has been abstracted in these columns, is reprinted in the "West. El.," Dec. 29, particularly the remarks concerning American practice by Messrs. Keith and Parshall. The article on Mr. Preller's paper from the Lond. "Elec. Rev." is also reprinted in the same journal.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Train Lighting.—"L'Elec.," Dec. 15, abstracts from "Genie Civil" a description of the lighting of the German post office cars; oil lamps were abandoned because of the danger of fire; experiments have shown that the electric lighting is successful in every way and is even cheaper than lighting by oil gas; at present 445 cars are lit electrically with 6 to 12 lamps of 12 cp and 30 volts, each car containing from 4 to 8 cases of 4 accumulators each which will run the lamps for 26 to 32 hours; the charging of the accumulators requires 15 hours and the capacity is 120 ampere hours; at one station 864 cells are charged at one time.

Rules and Regulations.—A system of rules proposed by the German Electrical Society to guard against fire risks is published in the "Elek. Zeit.," Dec. 20; they are about to be discussed at a subsequent meeting of the Society; they do not admit of being abstracted. Installations are divided into four different groups, different rules being given for each group.

Central Stations of Great Britain.—The Lond. "Elec. Rev.," Dec. 21, publishes a supplement containing a list of the central stations in Great Britain with a brief description of each one; the data are not tabulated nor are any general conclusions given.

Cologne.—A well illustrated description of this station is concluded in Lond. "Engineering," Dec. 21.

Central Stations in Europe.—The table with some descriptive matter from "L'Ind. Elec.," recently referred to in these columns, is reprinted in the "West. El.," Dec. 29.

WIRES, WIRING AND CONDUITS.

Insulated Cables.—According to the "Rev. Ind.," Dec. 15, Mr. Snedekor has suggested the following process: After coating the conductor with vulcanized India rubber, it is covered with a paste formed of 40 parts by weight of magnesia, 28 of talc, 15 of finely pulverized asbestos, 30 of liquid glue, 15 of glycerine and 0.25 of bichromate of potash or of soda; the cable is then passed through a bath containing 180 litres of water, 27 klg. of silicate of soda and 13.5 of alum; it is then dried and covered with a coating of 40 parts of sulphide of carbon and 80 of asphalt.

ELECTRO-PHYSICS AND MAGNETISM.

Tesla Effects With Influence Machines.—The conclusion of the lecture by Dr. Toepler (see Digest Dec. 29) is contained in the "Zeit. f. Elek.," Dec. 15. He showed the experiment in which an incandescent lamp was brilliantly illuminated, although shunted by a thick wire bent in the form of a loop, and to show that it was due to surface conduction he added a thin but wide sheet of metal bent like the wire and connected to it, which, therefore, greatly increased the surface but scarcely affected the cross section, the lamp in this case diminished greatly in candle power. With such high frequency currents iron has the opposite effects in a transformer than with the usual currents, which he showed with the aid of a lamp run from a high frequency transformer in which the iron could be introduced or withdrawn; a core of insulated copper wires produced no effect but a glass rod covered with tin foil almost extinguished the lamp. He gives the data for 4 coils and describes various experiments with them; he showed that there was a very appreciable repulsion between the coils of a transformer; by transforming the high frequency current to another of lower voltage and greater current, iron wires were melted and a sort of arc light consisting of a point of carbon resting on another could be lighted; other experiments were shown by transforming the high tension currents still higher. He performed the experiment of illuminating a Tesla single pole lamp, in which case, however, the glass opposite the filament soon became very hot; in one case the voltage was so high that the whole transformer was surrounded with light in the form of a brush discharge; he estimates that the voltage was 500,000; although of considerable intensity, these high tension currents give off comparatively little heat. Geissler tubes placed near two condensor plates, but not in contact, were so brightly illuminated that the experiment could readily be shown in daylight. In conclusion he states that almost all the Tesla experiments can be shown with his large 60 plate machine, but perhaps not on such a brilliant scale, the difference, however, is not as great as would appear from the difference in the amount of power used (concerning which, however, he unfortunately gives no data).

Tesla's Researches.—A lecture of Dr. Tuma on Tesla's researches is briefly abstracted in the "Elek. Zeit.," Dec. 20. According to Prof. Puluj there are two chief drawbacks against the use of this "light of the future," one being that with such high tension currents there is a generation of ozone which is as dangerous to breathe as chlorine gas; and the second is that a sufficiently durable insulation cannot be obtained; he also stated that Prof. Puluj showed similar lamps as early as 1880; they were run from a Ruhmkorff coil, and are said to have had a greater candle power than those of Tesla; references to the description are given; he states that long ago, in the eighties, Mr. Von Marxow showed experimentally that the physiological action of alternating currents is less, the higher the frequency.

Temperature of the Arc.—A paper by Mr. Violle from "Comptes Rendus," Vol. 114, page 949, is published in "L'Eclairage Elec.," Dec. 8. He used currents up to 1,000 to 1,200 amperes; from photographic observations he finds that the brilliancy of the positive crater is still exactly the same with these currents as with 10 amperes, and he believes, therefore, that what takes place in the crater is the physical phenomenon of the vaporization of the carbon, which is characterized by a constant temperature and which is the same as that which he has measured up to 400 amperes. In conclusion he states that the temperature of the arc is generally higher than that of the positive carbon and that it increases with the energy.

Origin of Frictional Electricity.—A translation of Mr. Christiansen's paper mentioned in the Digest Dec. 22 is given apparently in full, with illustrations, in the Lond. "Elec. Rev.," Dec. 21.

Slow Changes in the Permeability of Iron.—In reply to the article on the open circuit loss in transformers (see Digest, Dec. 29 and Jan. 5), Mr. Mordey, in the Lond. "Elec.," Dec. 21, states that he has been investigating this subject and has obtained some interesting results which he has communicated to the Royal Society, and he can, therefore, not discuss the matter at present, but he gives the conclusions to which he has been led, which are as follows: "1. The effect is not fatigue of the iron caused directly by repeated magnetic reversals; it is not progressive magnetic fatigue. 2. Neither magnetic nor electric action is necessary to its production. 3. It is a physical change resulting from long continued heating at a very moderate temperature. 4. It is greater if pressure is applied during heating. 5. It is not produced when the iron is allowed to rise more than a few degrees above the ordinary atmosphere. 6. It is similar to the effect produced by hammering, rolling, or by heating to redness and cooling quickly. 7. The iron returns to its original condition on reannealing. 8. It does not return to its original condition if kept unused and at ordinary atmospheric temperatures, whether the periods of rest are short or long." The practical outcome of the matter is that transformers should be made larger, more costly and less efficient, if this effect is to be avoided, or that the increase, if it occurs, should be endured; the latter is, in his opinion, the preferable course; the importance of the effect may be over-estimated on account of the low values of the magnetizing losses; a 40 per cent. increase really means an increase of only 0.388 per cent., as it is 40 per cent. of 0.97 per cent.

Mr. Wilson, in the same journal, states that he has made a long series of experiments with a 2-kw Westinghouse transformer, which results bear out some of Dr. Fleming's remarks; after 6 hours running the losses were smaller than at the commencement by about 4 per cent.;

he also states that the form of the current is most important and that for the same alternator it is a function of the load.

Modern Theories as to Electricity.—An article with this title by Prof. Rowland is contained in the "Eng. Mag." for January. The article should be read in its entirety, but the following will give a general idea of its contents. He states that it is now certain that electricity no longer exists, meaning electricity in the old sense of the word, in which it refers to a fluid; "there is nothing more certain to-day than that electricity is not a fluid." He describes Faraday's magnetic and electrical lines of force, specially the latter; if the two poles of a battery terminate in two balls, the battery generates lines of force which "crowd together around it and push each other sideways until their ends are pushed down the wire and many of them are pushed out upon the balls," thus charging the balls with electricity; "the motion of the ends of the lines of force over and in the wire constitutes what is called an electric current," which is accompanied by magnetic action around it and by electromagnetic waves which pass outward into space. When glass is rubbed the glass can be supposed to take hold of one end of the lines of force and the rubber the other end, and it is only necessary to pull the bodies apart in order to fill the space with lines; all electrification is originally produced by separating the atoms of the bodies either by breaking contact or by chemical action; these electrostatic lines must always begin and end on matter, and they cannot end in or pass through a vacuum which is a perfect non-conductor; very little is known of the nature of resistance or conduction; neither electrostatic nor magnetic lines of force can move without being accompanied by the other. Regarding variable currents, he states that the electrical vibrations must be very violent before waves carrying much energy are given out; the velocity of these waves is nearly 300,000 kilometers per second, which is exactly the velocity of waves of light, and there is no doubt at present that these waves of radiation are electromagnetic waves. He then discusses at some length the properties which ether must have in order to account for these and other phenomena; to account for the earth's magnetism the rotation of matter in the ether must produce magnetism; to account for gravitation, two masses of matter in it must tend to move toward each other according to the known law, but without any loss of time in the action of the force; the moving electric or magnetic bodies, however, require a time represented by the velocity of light before they can attract each other. The theory of electricity and magnetism reduces itself to the theory of the ether and its connection with ordinary matter; he discusses what the ether must explain in order that one may imagine its nature; he concludes that ether is not matter but something on which many of the properties of matter depend; to explain magnetism physicists usually look to some rotation in the ether; a smoke ring gives to some extent the modern idea of a magnetic line of force; electrostatic action is more difficult to explain, but there is a vague idea that it is due to some sort of elastic yielding of the ether.

Mirrors of Magnetism.—The recent paper by Prof. Thompson and Mr. Walker mentioned in the Digest, Dec. 22, is abstracted briefly in the "West. El.," Dec. 29.

ELECTRO-CHEMISTRY AND BATTERIES.

Accumulators.—The Boese system (which the compiler believes is used on the German postal cars) is described and illustrated in the "Zeit. f. Elek.," Dec. 15; the object is to combine a number of glass cells in one retaining box and mount them rigidly, but with sufficient elasticity to prevent them from being injured when used for portable or traction purposes; a set of glass cells are inserted in a box, into which is then poured a melted mass of some insulating material, of which he mentions a large number, which when cold are rigid, but elastic, and will retain the liquid even if the glass cell should break.

Preparation of Magnesium and Lithium.—A laboratory apparatus for obtaining these elements electrolytically in a furnace, devised by Mr. Borchers, is described and illustrated in "L'Eclairage Elec.," Dec. 8, the elements, together with berylium, are obtained from their fused haloid salts. The same journal describes and illustrates Chaplet's electric furnace, in which an inclined retort containing the material is heated by means of arcs, the molten metal being collected in the bottom and drawn off.

Electric Tanning.—As was stated in these columns a number of times, the Groth system has been introduced on a large scale in the town of Orbe, Switzerland. According to the "Elek. Anz.," Dec. 20, the process has been abandoned, as it was found to be too expensive.

Cyanide Process of Extricating Gold.—"L'Eclairage Elec.," Dec. 8, contains another article by Mr. Andreoli on this subject, in which he refers more particularly to the recent litigation in England.

Electro-Chemical Works.—The "Elec. Tech.," Dec. 15, gives a list of the electro chemical works which have been installed in Germany and Austria during the past year; chlorine and alkali works were installed at Bitterfeld and Vienna, the Kellner process being used in the latter; zinc works at Duisburg, where the Dieffenbach process is used; carborundum works at Iserlohn, Germany, where the Acheson process is used.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Central Station Instrument Equipment.—An article on this subject by Mr. Nalder is published in Lond. "Lightning," Dec. 20. For insulation he recommends a highly sensitive galvanometer, with shunts, etc., and with a sufficient number of cells to equal the working voltage; he recommends the use of an indicating apparatus for recording any change in the insulation; in the Wallis-Jones method a clock connects one side or the other of the mains alternately to earth through a recording galvanometer; for keeping a record the Cardew indicator is in use for alternating current systems, and consists of a recording galvanometer of the moving coil type in circuit, with a reactive coil of low resistance but of high inductance, and a battery of cells which is attached to one side or the other of the mains and earthed at the other ends; the battery current is, therefore, used independently of the alternating leakage current. For a standard ammeter he recommends the Kelvin balance; for direct currents only a potentiometer is often preferred. He describes and illustrates such an instrument, one of the features of which is that there are two cells, one of which is used in measuring, while the second can be compared with it by connecting them in series through a galvanometer, but opposed to each other. For direct currents he recommends permanent magnet volt meters; the deterioration of the magnet has recently been overcome "by making the control wholly due to the field which in the coil moves; any change thus effects the control and turning moment alike and the reading remains constant;" for alternating currents of about 100 volts he recommends a static volt meter of the electromagnetic type, when calibrated for the proper frequency; for low voltage, static instruments usually give too small readings; to free an ammeter from disturbance on the switch board it should be astatic; when very large direct currents are to be measured a fall of potential method and a reflecting D'Arsonval galvanometer give the widest possible range.

Measuring Small Resistances.—The Lond. "Elec.," Dec. 21, abstracts briefly from "L'Elettricista" a description of a new method by Dr. Pasqualine. It requires no special apparatus and consists in using a coil composed of a few turns of wire wound double so that there are two similar circuits; it is fixed to the case of an ordinary galvanometer so as to act on the needles; the main current which passes through the resistance to be measured passes through one of the circuits on this coil; a shunt circuit to the resistance is formed by the second circuit of the coil, the galvanometer and the resistance box; the main and the shunt current tend to turn the needle in opposite directions, and the resistance of the shunt circuit is varied until the deflection is zero, in which case the resistance is equal to that of the shunt circuit divided by the galvanometer constant and multiplied by the "constant which expresses the effect of either of the circuits in the auxiliary coils on the needle;" the ratio of these two constants can be obtained by performing experiments with a known resistance. With an auxiliary coil containing two circuits of four turns each and a Wiedmann galvanometer of 8 ohms, he can measure a resistance of .002 ohm within $0.004 \times C$ (?), in which C is the total main current; a standard ohm was used to determine the ratio of the constants.

Simple Student's Apparatus.—A Physical Society paper by Prof. Ayrton and Mr. Haycraft on such an apparatus for determining the mechanical equivalent of heat, is abstracted briefly and discussed in the Lond. "Elec.," Dec. 21; the same issue also contains an editorial on this subject. This apparatus enables the student to find the mechanical equivalent, correct to 1 per cent., without having any corrections to make. A current is passed through a strip of manganin ¼ inches wide, 0.03 in. thick and 5 ft. long bent into zigzags; it is immersed in 2,000 cb. c.m. of water, the current, the difference of potential, the temperature and the time being measured; a certain minimum time is required and "the ratio of the heat lost to the heat generated must be kept equal to the probable error in the time or temperature measurement;" calculations show that the error is proportional to the 6th root of the mass of the water; the time adopted was 2 minutes, during which the rise of temperature is about 3.87°, the resistance was less than ⅓ ohm, the current 30 amperes and the heating surface about 60 sq. in.; an example is worked out; the result obtained being 779 foot-pounds. In the discussion Mr. Griffiths disagreed regarding the educational value of such an apparatus, as it failed to familiarize the student with the intelligent application of corrections. Prof. Foster objected to the use of direct heating instruments by students, as they give no scientific information. Prof. Thompson stated that this was a good example in choosing the proper dimensions for an experiment; he denied that the use of direct heating instruments was harmful, and asked where the line should be drawn between old-fashioned and new instruments. Dr. Sumpner described an apparatus which he had been using for a similar instrument; it consisted of a length of flexible tubing through which a current was passed while it was kept cool by a stream of water passing through it, the difference of temperature of water at the two ends being measured; he believes that fully as good results could be obtained; the correction for cooling could be eliminated by having the temperature at one end as much greater than that of the air as the other end was lower; he thinks that young students should be given simple instruments in which corrections could be neglected; they could proceed to take corrections into account afterwards. Prof. Ayrton, in replying, stated that the object of the present instrument

was not to learn how to make corrections, but to learn what was meant by the mechanical equivalent heat.

Large Wheatstone Bridge.—A view from Dr. Edelmann with five decimal resistance coil groups, is described and illustrated in the "Elek. Zeit.," Dec. 20.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Telephone System.—An improvement described and illustrated in the "Elec. Zeit.," Dec. 20, consists in the combination of the induction coil with the call; the usual spools for the call bell are coils wound with primary and secondary windings, which are then used as the induction coils, the results being economy in material and simplification of the system, also that the call is always in circuit, it being then possible to call the subscriber even if he has forgotten to hang up the telephone.

Constructing Relays.—In an article by Mr. Schebesta in the "Zeit. f. Elek.," Dec. 15, he discusses in detail and at some length the best construction of relays, giving the results of numerous measurements and deductions; the article does not admit of being abstracted.

Carbonelle Microphone.—"L'Ind. Elec.," Dec. 10, contains an article of some length, describing the advantages of the system of Mr. Carbonelle, in which the microphone has a very great resistance, about 1,000 ohms at rest, and from 6,000 to 8,000 during a conversation; the system is said to be much more economical and to increase considerably the limits of the transmission. In the ordinary system in which an induction coil is used, the increase of the resistance due to the variations in the contact does not even double the resistance of the primary circuit, but even admitting that it is doubled, it is shown that the energy utilized is only 2 per cent. of that furnished by the battery; another serious inconvenience due to the use of the induction coil is that the battery is required to be maintained at the subscriber's end of the line; in the present system the induction coil itself is rendered unnecessary, and the battery is placed at the station end; the magneto is used for the call; for network of 3,000 subscribers, ten times as many batteries are required in the present system used in France than would be required for this new system; detailed calculations are given, showing that 112 times as much energy is used with the ordinary microphone and induction coil than with the Carbonelle system, which latter requires 0.01 watt for two subscribers, assuming that three cells are required for two subscribers in the ordinary system. He shows the application to long distances, and states that the limit stated by Mr. Preece does not apply, as experiments with this telephone on artificial lines have shown that the product of the ohms and microfarads exceeds 100,000; with the Carbonelle system the transmission is still very good for limits at which transmission by the ordinary system is impossible; the instrument itself (which is not described) is said to be robust and does not require repeated adjustments; for long distances it is only necessary to increase the electro-motive force; the operating cost is said to be considerably cheaper and the changes from the old to the new system are said to be very simple.

Telephone System in Paris.—A well illustrated description by Mr. Hospitalier is begun in "La Nature," Dec. 15.

Storage Battery in Telegraph Offices.—An article on this subject is begun in the "Tel. Age.," Jan. 1; it is quite elementary in character, the present portion being devoted mainly to an elementary description of accumulators.

MISCELLANEOUS.

Treatment in Case of Accidents.—An editorial in the Lond. "Elec. Rev.," Dec. 21, discusses Dr. Gibbon's offer to test the question of whether criminals executed in New York are really killed by the current. Such experiments on criminals as he proposes to make would probably prove nothing; they would show simply that the execution had not been carried out properly. It claims that it is reasonable to suppose that D'Arsonval's treatment would be successful in cases where lesions have been set up. The College of France recommends in cases of suspended respiration the application of the faradic current on both sides of the larnyx under superficial incision in the skin; amongst other remedies there is a use of nitro glyceirne in 1 per cent. solution, in two drop doses, dropped at intervals on the tongue; this is the most powerful heart stimulant known to the medical profession; failing this, stimulants, such as alcohol, ammonia, etc., are recommended, for the purpose of arousing the cerebro spinal system to action.

Carbide of Calcium.—Prof. Henry Morton of Hoboken in a communication to Lond. "Engineering," Dec. 21, refers to a production of this material in the Moissan electric furnace, from a mixture of lime and coal dust, and states that it has the remarkable property that in contact with water it develops a large amount of gas which appears to be chiefly acetylene; if a fragment is sprinkled with drops of water, gas will be given off which will continue to burn until this stone is entirely converted into lime; by introducing this material in a closed vessel connected with an automatically regulated reservoir of water, illuminating gas can readily be obtained. Whether the cost of producing this compound is too great for industrial application remains to be shown.

Utilization of Ozone.—The paper of Dr. Froelich abstracted in the Digest, Nov. 17, is abstracted in the Lond. "Elec.," Dec. 21.

Biographical.—The biography of Hertz, of some length, is published in "L'Eclairage Elec.," Dec. 8.

New Book.

ON THE DEVELOPMENT AND TRANSMISSION OF POWER FROM CENTRAL STATIONS. Being the Howard Lectures delivered at the Society of Arts, in 1893, by Wm. Cawthorne Unwin, F. R. S., London and New York: Longmans, Green & Co. 308 pages, 81 illustrations. Price, $3.50.

The author needs no introduction to his now extended American audience, in adding another valuable book to the engineers' library and a pioneer production in its field. The subject is here treated as a whole; at the same time it is recognized as a very wide field and as touching many different departments of engineering.

The opening chapter of 18 pages treats briefly of "the conditions in which a system of distribution of energy is required, and general considerations on the sources of energy." The author acknowledges more familiarty with mechanical than electrical methods of distribution; but believes this disadvantage may be offset "in approaching the subject for once with the bias of an engineer rather than that of an electrician." The sources of mechanical energy are given consideration somewhat disproportionately to their practicability: wind power; water power; tidal action; solid, liquid and gaseous fuels; with a third of the chapter on the production of power by burning town refuse in "destructors."

The generation of power by steam engines, the cost of steam power and the distribution of power by steam are treated in chapters II., III., and XI., respectively: 58 pages in all. The six valuable tables of engine and boiler performance are followed by smaller compilations of results; but, one must read the context to determine the intrinsic value of many tables,—whether calculated from assumed conditions or the results of experiments. The efficiency of the steam jacket, superheating and multiple or "stage" expansion, with reference to cylinder condensation; the relations of mechanical efficiency, back pressure, type, speed, and mode of regulation of steam engines under varying loads, are followed by a presentation of Willan's law of steam consumption. Under steam turbines the velocity of efflux of steam is calculated by the hydraulic formula, when it has been established by many repeated experiments, that steam does not, like water, flow from an orifice with a velocity due to its gravity head. The velocity is represented by its discharge as calculated by Napier's formula, when the final pressure is less than 3-5 the initial, as it must be in all steam turbines. The cost of steam power is from an English view point; while Dr. C. E. Emery's contributions are entirely drawn upon and acknowledged as containing "nearly all the information available on the subject of steam distribution," as developed in New York City.

The storage of energy forms the subject matter of the 12 pages of Chap. IV. Fly-wheel, gas-holder, hydraulic, compressed air, and "accumulator" storage are all too briefly treated. Half the chapter is taken up with "thermal" storage, the proposed plans of whose chief exponent, —Mr. Druitt Halpin—"appear to be practicable and to promise considerable economy in stations where the load fluctuates greatly; but, they are untried."

Water power, hydraulic motors and hydraulic transmission are more fully considered in chapters V., VI., and VIII., respectively; 62 pages in all. The development of natural water powers in Switzerland and America are satisfactorily treated, in a general way; and, the more important cases in detail. Dr. Thurston's paper, before the American Society of Mechanical Engineers is drawn upon for the description of the Holyoke testing flume. Two pages on the "storage of water power" belong under a former chapter. Turbines are described and classified (to the exclusion of the Pelton type); and, treated as to efficiency, regulation and choice of type. "The limit turbine" must be a typographical error, for the book has had very careful proof reading. High and low pressure transmission, with their respective accumulator and reservoir methods of storage are described, with English examples of the former and Swiss of the latter.

Telodynamic transmission receives a share of consideration, in the 21 pages of chapter VII. It is confined entirely to wire-rope transmission on the Continent, with the exception of the plant at Gokak, India, installed by Swiss engineers. The Schaffhausen wire-rope transmission is very fully treated, as being a typical adaptation to complex conditions, side by side, with an electrical system lately installed for similar work at the same place. The differential gear (an epicyclic box train), equalizing the rope tensions of the Schaffhausen plant, is not in similar use elsewhere, to the author's knowledge; but, is very extensively used in American cable railway work, and known as Whitton's compensator.

Transmission of power by compressed air is given the lion's share of attention, in the 82 pages of chapters IX. and X. The latter is mainly a reprint of Prof. Unwin's paper, on the "Calculation of a Compressed Air Transmission when the Subsidiary Losses of Energy are taken into account." The Theory of isothermal and a diabatic workings are treated analytically and graphically. The "false hydraulic analogy," regarding flow of air, is pointed out and avoided. The thermodynamic questions involved in working air are ably presented, as well as the economics of this method. Descriptions of the various English and Continental compressed air installations are given, beside the chief example of its extensive use in Paris. Prof. Unwin and Prof. Riedler could

not but come to different conclusions, as stated; we await some agreement regarding frictional losses in mains, etc., between two such advocates of air transmission.

The distribution of gas for power purposes is considered in the 8 pages of chapter XII., and the combined electric lighting and gas plant of the Dessau central station taken as typical. Dowson gas is most largely noted; Mr. Carnegies' contributions to the development of Pittsburg natural gas are alone drawn upon; and, the author's own formula alone given for the flow of gas in pipes, notwithstanding the development of high-pressure transmission of natural gas by American engineers, especially of Prof. S. W. Robinson.

Electrical transmission receives attention in Chap. XIII., and, together with the examples of power transmission by electrical methods of Chap. XIV., and the utilization of Niagara Falls described in Chap. XV., constitute 45 pages. "The striking Lauffen-Frankfort experiment" is dismissed too briefly. The analogous "hydraulic flow" is now considered as if in place, followed by an analytical treatment of size, heading and cost of conductors, with Lord Kelvin's formula for the most economical sectional area. Several "calcu ated" tables follow; in them "pressure in volts" is referred to in the text as "potential difference at the terminals of the generator" and designated by E; and "intensity of cur ient" is otherwise referred to as "current I in amperes." Diagrams show series, parallel and multiphase distributions; of the latter, the Westinghouse and "Diehstrom" are given. The Genoa installation receives fullest consideration of several continuous current transmissions at home and abroad. Of the actual transmissions by alternating current the Lauffen-Heilbronn and Telluride (Colorado) are selected, and acknowledgments for the latter made to Mr. C. F. Scott's paper before the American Society (?) of Electrical Engineers. While the utilization of Niagara is popularly treated and some note taken of the then developed work of the Niagara Falls Paper Co., still we expected a somewhat fuller treatment, considering Prof. Unwin's early connection with and continued interest in the engineering features of the same.

The book is fairly indexed, considering the vast amount of valuable engineering data presented; well printed, but the cuts of several installations are disappointing to the engineer; structural details and diagrams are clearly shown. It is not too largely descriptive; but, we looked for the author's well-known discriminating treatment of theory and happy selection of practical examples and details shown in the make-up of his other works. We feel that he has left a great deal unsaid in directions where we were justified in looking for more detailed treatment. In the study of the generation, transmission, distribution and utilization of power, Prof. Unwin has supplied a long-felt want; and the up-to-date features of his other works we may expect to be maintained in successive editions of this one.

Moonlight Tables for February, 1895.

Herewith we give Mr. H. W. Frund's table of lighting hours for the month of February, under his modified form of moonlight schedule:

TABLE NO. 1, Standard Moonlight System.

Date.	Light.	Date.	Exting.
1	11.10 P. M.	2	6 10 A. M.
2	.....	..	....
3	12.10 A. M.	3	6.10 A. M.
4	1.20 "	4	6.10 "
5	2.30 "	5	6.10 "
6	3.40 "	6	6.10 "
7	4 50 "	7	6.00 "
8	No light.	8	No light.
9	"	9	"
10	6.00 P. M.	10	7.50 P. M.
11	6.00 "	11	9.10 "
12	6.00 "	12	10.30 "
13	6.00 "	13	11.40 "
14	6 00 "	15	12.50 A. M.
15	6.00 "	16	1.50 "
16	6.10 "	17	3.00 "
17	6.10 "	18	4.10 "
18	6 10 "	19	5.10 "
19	6.10 "	20	5.50 "
20	6.10 "	21	5.50 "
21	6.10 "	22	5.50 "
22	6 10 "	23	5.50 "
23	6 10 "	24	5.50 "
24	6 20 "	25	5.40 "
25	6.20 "	26	5.40 "
26	6.20 "	27	5.40 "
27	6.20 "	28	5.40 "
28	9.00 "	1	5.30 "

TABLE NO. 2, Frund's New Moonlight System.

Date.	Light.	Date.	Exting.
1	5.50 P. M.	2	6.10 A. M.
2	" "	3	6.10 "
3	" "	3	12.00 M.
4	1.20 A. M.	4	6.10 A. M.
4	5.50 P. M.	4	12.00 M.
5	2.30 A. M.	5	6.10 A M.
5	5.50 P. M.	5	12.00 M.
6	5.50 "	6	12.00 "
7	5.50 "	7	12.00 "
8	5.50 "	8	12.00 "
9	5.50 "	9	12.00 "
10	6.00 P. M.	10	12.00 "
11	6.00 "	11	12.00 "
12	6 00 "	12	12.00 "
13	6.00 "	13	12.00 "
14	6.00 "	15	12.50 A. M.
15	6.00 "	16	1.50 "
16	6.10 "	17	3.00 "
17	6.10 "	18	4.10 "
18	6.10 "	19	5.10 "
19	6.10 "	20	5.50 "
20	6.10 "	21	5.50 "
21	6.10 "	22	5.50 "
22	6.10 "	23	5.50 "
23	6.10 "	24	5.50 "
24	6.20 "	25	5.40 "
25	6.20 "	26	5.40 "
26	6.20 "	27	5.40 "
27	6.20 "	28	5.40 "
28	6.20 "	1	5.30 "

NOTE.—These schedules are made up on sun time. Where standard time is used and it varies considerably from sun time, the proper deduction or addition must be made to all the times here given.

A Swiss Mountain Electric Railway.

The Swiss Federal Government has recently granted a concession for the construction of a mountain electric railway, starting from near Lauterbrunen. The line will be about 12½ kilometres long, and is to be finished within five years.

The Callender Telephone Exchange System.

Hitherto the conception of an automatic telephone exchange system has been of one in which each subscriber would have an individual switching mechanism at the central station or exchange. Statistics show that the maximum number of telephones in use at one time rarely exceeds 20 per cent., and that in large cities 10 per cent. may be a safe maximum.

Mr. Romaine Callender, whose name is widely known in telephone circles will soon give an exhibition at the Decker Building, Union Square, New York, of a system telephonic intercommunication based on these statistics, and planned to eliminate all unnecessary mechanism and connections by providing connecting capacity enough to receive the maximum number of calls arriving at the exchange during any portion of the day.

The aim of the system is to divide the telephone exchange apparatus in two groups, proportioned to the length of time they will be in use when active; it being understood that as soon as the various mechanisms in the several divisions have performed their functions they revert instantaneously to common use.

The apparatus for enabling the subscribers to interconnect themselves automatically at will is divided into two principal portions; first, apparatus at the subscriber's station, and second, apparatus at the exchange station.

Before describing the electrical and mechanical features of the exchange apparatus, it may be well to refer to the apparatus at the subscriber's station. This consists of a telephone transmitter, receiver, battery and call-bell, together with a signaling transmitter of special form. This signaling transmitter, Fig. 1, is provided with means for transmitting electrical impulses in series or sets to the exchange station. It consists of an insulated rotatable cylinder, Fig. 2, carrying ten contact strips of varying length. Held against the cylinder are ten contact rushes. One of these is adapted to make electrical connection successively with each one of the contact strips on the clyinder, when the said cylinder is rotated. Another of the contact brushes connects with only nine of the contact strips, while the next brush connects with only eight strips, and so on to the tenth brush, which makes electrical connection with only one of the contact strips. This circuit making and breaking cylinder has electrical connection with a series of hand operated indicator switches, Figs. 3 and 4, located on the front of the signaling transmitter case. Each of these switches is adapted for indicating any one of a series of numerals, 0 to 9 inclusive.

The number of the switches is equal to the number of numeral places in the value of the highest numbered line in the system—that is to say, in a system of not more than two numeral places, up to 99, two switches are necessary. In a system of three numeral places, up to 999, three switches are required, and so on. The impulse transmitting cylinder revolves as many times as there are indicator switches on the outside of the case. In a system of not more than 99 telephones the cylinder is caused to revolve two complete revolutions, together with an extra preliminary revolution for a purpose that will be described later. In a system of not more than 999 telephones it revolves three times. The preliminary revolution just referred to is for transmitting a preliminary impulse to the exchange station for the purpose of seizing some unused portion of the percentage apparatus; the succeeding revolutions being for transmitting the signaling impulses representing the thousands, hundreds, tens and units in the number of the telephone with which connection is desired.

The mechanism of the signaling transmitter includes a controlling commutator for changing the circuit through the several indicator switches in succession. To illustrate its working it will be necessary to suppose that a call is just being turned in for connection with some other telephone, say number 684. Three of the signaling transmitter indicator switches would be set in numeral order, from left to right, so that the left hand switch would indicate 6, the middle switch 8, and the right hand switch 4. The controlling commutator, by changing the circuit through the indicator switches from left to right successively for each rotation, causes impulses the equivalent of 684 to be transmitted to the exchange station.

Although one of the indicator switches may be arbitrarily designated as the hundreds switch, and another as the tens, etc., it is not necessary that this should be done. A signaling transmitter for a system of not more than 999 lines has three indicator switches. Should it be desired to signal for connection with telehpone number 6, only one of the indicator switches is required to be set. It does not matter which one of the switches is set, the result will be six impulses transmitted. Should connection be desired with telephone number 59, two of the indicator switches will be required to indicate this two numeral value. This may be indicated on the first and second dial, on the second and third, or on the first and third, the only conditions being that the numbers must be set so as to read from left to right, to correspond with the present system of expressing numeral values. The impulses as they arrive at the exchange are automatically classified into hundreds, tens, etc., in a manner to be described later. The signaling transmitter is set in operation by a lever which projects from the side of the transmitter case. The lever

when drawn down stores up energy in a coiled spring. The coiled spring operates a wheel train and fan, with which are connected the circuit making and breaking cylinder and its controlling commutator. This controlling commutator revolves only once at each operation, but the circuit-making and breaking clyinder revolves as many times as there are numeral places in the value of the highest numbered line in the system, as has already been explained.

Before entering on a detailed description of the apparatus at the central station it will be well to outline the mode of operation. It will be remembered that in connection with the description of the signaling transmitter, mention was made of a preliminary impulse. Whenever a signal is transmitted to the central station, the preliminary impulse pre-

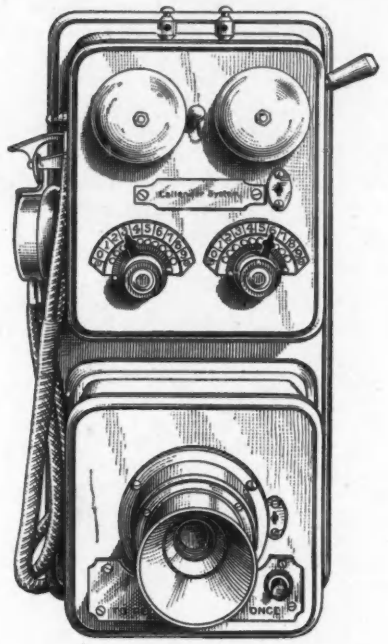


FIG. 1.—SIGNALING TRANSMITTER.

cedes it and causes the seizure and isolation of one of a number of connecting strips controlling access to mechanisms for registering the number of the telephone with which connection is desired. The signaling impulses, as they arrive at the exchange, are registered on one or more instruments designated "Numerical Receivers," Fig. 5. Each series of impulses, corresponding to hundreds, tens, etc., is registered on a separate receiver.

In series with each group of numerical receivers is an instrument designated the "Numerical Separator," Fig. 6. The office of the separator is to distribute the different sets of impulses to their respective

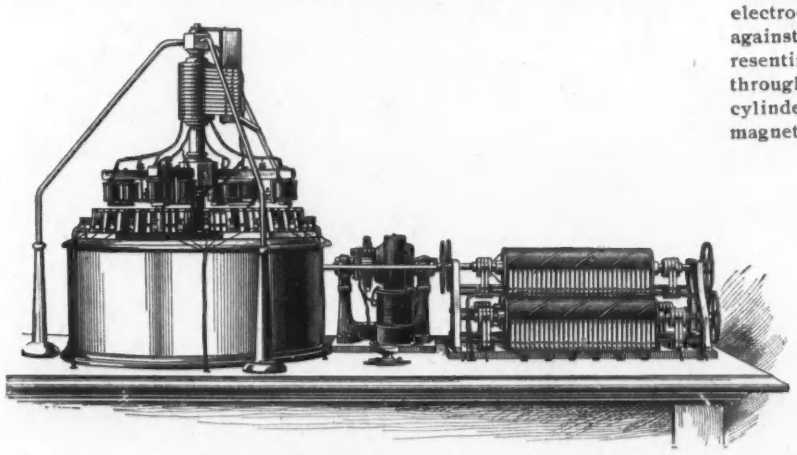


FIG. 2.—CIRCUIT SELECTOR.

receivers, so that if a call is turned in, for say number 36, the separator divides the first set of impulses from the second, and causes them to be registered on two different receivers—the tens on one, the units on the other.

An instrument known as the "Numeralizer," Fig 7, now comes into play and totalizes the indications of hundreds, tens, etc., and then selects the circuit of equivalent numerical value. The signaling telephone is then connected to the telephone signaled for, and at the same time a copper ball, which has been released over a signaling track, runs along it by gravity and causes the call-bells of both subscribers to be operated, notifying them of their interconnection. Each of the foregoing divisions reverts to common use as soon as it has done its share in the making up of the complete connection; the connector only remaining in use during the time that conversation is being held over the connected lines.

Returning now to the apparatus at the central station, the construction and specific functions of the circuit selector, Fig. 2, will first be noticed. This consists primarily of a series of metallic conducting rings, insulated from each other and held concentrically on the same plane. Around each ring is arranged a series of armature-headed plungers. These plungers are normally electrically disconnected from the conducting ring, but are adapted to be moved into engagement with the said ring under the influence of electromagnets carried by revolving arms; each ring of plungers lying in the path of one of these electromagnets. Each conducting ring represents a distinct percentage division, and each controls access to the mechanism of its division. The plungers are terminals of branch conductors from each telephone line and they serve as connectors for establishing a circuit from a signaling telephone to

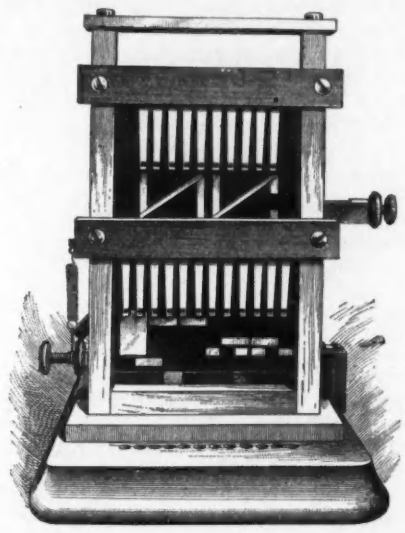


FIG 4.—PROGRESSIVE SWITCH.

the signal-receiving mechanism of the division seized and held for the time being by the said signaling telephone.

The branch conductor just referred to may be connected at will to any one of the conducting rings through the instrumentality of the plunger and the controlling electro-magnet. It will be understood that one electromagnet controls one ring of plungers, and the selection of any one plunger is governed by an auxiliary mechanism, about to be described. This consists of one or more revolving cylinders carrying oblique contact strips. These strips are insulated from each other, and each strip has electrical connection through a commutator, with its corresponding electro-magnet revolving over its appropriate ring of plungers. Held against the revolving selector cylinder is a series of contact brushes, representing terminals of branch conductors, adapted to complete a circuit through the selector under certain conditions to be described later. The cylinder and the revolving arms carrying the plunger-selecting electromagnets are geared together and are revolved by a constantly operating

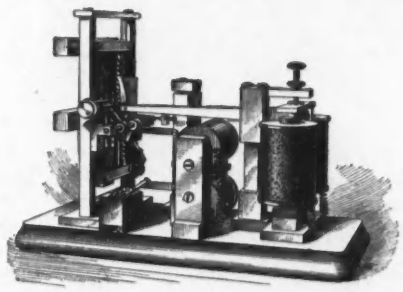


FIG. 3.—PROGRESSIVE SWITCH.

electro-motor. By this means the brushes against the revolving cylinder are brought into electrical connection with the oblique contact strips successively, and one at a time. As each contact brush engages with an oblique strip the arrangement is such that the plunger-controlling electro-magnet, electrically connected with the said oblique strip, will be immediately over the plunger of that line corresponding to the number of the brush in engagement with the oblique contact strip. There are as many oblique strips on the cylinder as there are sets of conducting rings and plungers.

The whole action of the preliminary impulse already referred to is to raise the plunger of the signaling line into electrical connection with

some one of the conducting rings. As soon as this is done the circuit is so changed that no other signaling telephone can obtain connection with the conducting ring just seized; the oblique conducting strip, although it will pass under other brushes representing lines over which signals are being received, will not be affected. Should two adjoining brushes be in condition to complete a circuit through the selector at the same moment of time there will be no interference, as the first unused oblique strip will be presented to one brush and become individualized to it instantaneously, while the next brush immediately following will not be affected until some other unused strip is presented to it. From this it will be noted that the effect of the preliminary impulse is prolonged for one complete revolution of the selector cylinder, so that should the greater part of the percentage system be in use at the time of the reception of such impulse, the rotation of the selector cylinder will eventually present an unused strip to the waiting brush.

The progressive switch, Figs. 3 and 4, is one of a group of instruments controlled by the circuit selector. The preliminary impulse in seizing a percentage division for the reception of a signal, seizes at the same time one of the progressive switches. The seized division of the circuit selector, which is only used for a few seconds, soon reverts to common use, but the progressive switch remains individualized for the use of the signaling line, until the connection is established. As soon as this

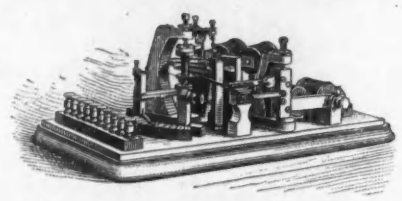


Fig. 5.—Numerical Receiver.

step has been effected the progressive switch also reverts to its normal condition, ready for use by any of the remaining lines. The action of the preliminary impulse translated through some one division of the circuit selector is to seize some one of the progressive switches, to individualize it to the signaling line, and in so doing to step the progressive switch forward one degree. This isolates the signaling line and prevents any other line from interferng with it in any way thenceforth until the progressive switch passes from under the control of the said signaling line.

The signaling impulses which now follow are registered on the receivers in a manner to be described later, and as soon as this registration has been effected the progressive switch is automatically stepped forward another degree. In this position the switch is connected to one of the signaling tracks, a description of which shortly follows. A constantly operating alternating current generator is then put in circuit with the signaling line, through the signaling track and progressive switch, for the purpose of ringing the call-bell at the outlying station; one long ring if connection is established, or two disconnected rings, a "busy" signal, if the line called for is in use. The progressive switch is then stepped forward another degree, leaving the connected lines in condition

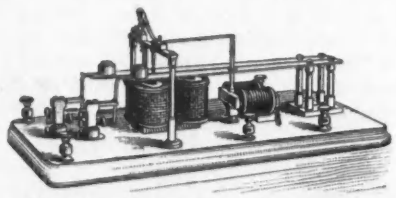


Fig. 6.—Numerical Separator.

for telephonic communication, or if the line called for is in use the signaling line is placed in condition for turning in other calls. The switch is restored to normal condition either by the act of the signaling subscriber releasing, or by a time limit apparatus at the central station, where such apparatus is used.

The foregoing action is that of a signaling subscriber using a progressive switch for the purpose of effecting a connection with the line of some other subscriber. These progressive switches work in pairs, the other switch being seized also by the signaling subscriber as soon as a registration has been effected of the number of the telephone with which connection is desired. The seizure of the second progressive switch individualizes it to the use of the telephone signaled for, and prevents any other telephone from connecting with it from that time until released. This seizure also puts the switch in condition for sending a call-bell signal over the line of the subscriber called. It is then automatically instrumental in establishing a talking circuit through an apparatus designated the "Connector," a description of which follows later.

The circuits are so arranged that when a call arrives at the exchange for connection with a telephone already connected and in use, no progressive switch can be individualized to the use of the busy line until it goes into disuse. An automatic change is effected on the proper signaling track, representing the division in which the signal is registered, and as a result of this change a busy signal is sent over the line of the signaling telephone, while the busy telephone is left undisturbed.

The numerical receiver, Fig. 5, registers the signaling impulses as they arrive at the exchange. They are assembled in percentage groups, the number of receivers in a group depending upon the number of lines in the system. In a system of not more than 99 lines, two numerical receivers are required in each percentage group. In a system of not more than 999 lines, three receivers form a group, and so on. In a three numerial place system, one receiver of a group registers hundreds, another receiver in the same group registers tens, while the remaining receiver of that group registers units. The number of receivers used in any group by an incoming signal depends upon the numerical value of the signal being registered. If a signal is received for connection with a telephone whose number may be expressed by one numeral place, as for instance number 8, then only one receiver is used in the group, the others remaining unaffected. If a signal is received for connection with a telephone whose number may be expressed by two numeral places, as for instance number 65, then two receivers are used, and so on.

The receivers are distinguished as being of the first, second or third

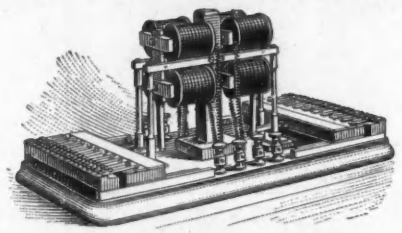


Fig. 7.—Numeralizer.

order in a three numeral place system. In any group, the receiver of the first order is first to be used, the others being brought into use sequentially, if required. If a signal is registered for connection with a one numeral place value, say number 8, the receiver of the first order then indicates the complete registration, which may be termed a units register. Should two sets of impulses be registered, as would be the case in a signal for connection with a two numeral place value, say number 65, the numerical receiver of the first order would register the first set of impulses, and the receiver of the second order would register the second set. The receiver of the first order, in this event, registers tens, while the receiver of the second order registers units. In the event of a signal arriving for connection with a three numeral place value, say number 926, the receiver of the first order would register the first set of impulses, while the receivers of the second and third order would respectively register the second and third sets of impulses. In this event, the registrations of the receivers of the first, second and third orders would be respectively hundreds, tens and units.

The receiver is a step-by-step apparatus of special construction for recording accurately the sum of the impulses received. It is adapted to take ten forward steps, corresponding to the numbers 0 to 9 inclusive.

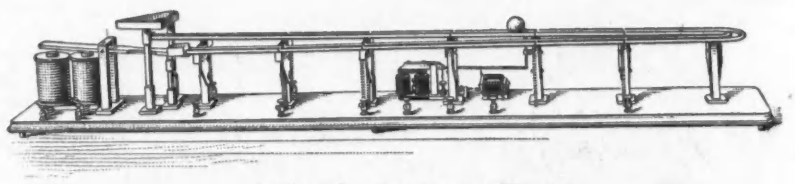


Fig. 8.—Signaling Track.

The various series of impulses are distributed to their proper receivers by an instrument designated the "Numerical Separator," a description of which shortly follows. One receiver can register nine indications, two receivers can register 99 indications, while three receivers can register 999 indications. Each receiver directly controls ten ractional branch circuits, and the varying combinations are totalized or integrated by an instrument described later under the caption of "Numeralizer."

A numerical separator, Fig. 6, is included in series with each group of numerical receivers. It consists of a controlling electro-magnet having two vibratory reed armatures. The reeds are adapted to be put into vibration for a predetermined length of time on the closure of a circuit hrough the controlling electromagnet. These reeds have different vibratory periods. After being put into vibration by the first series of signaling impulses, the shorter reed first comes to a position of rest and closes a circuit for switching the succeeding series of impulses through the numerical receivers sequentially.

The separator is normally in series circuit with the receiver of the first order, and its action, after each series of impulses, is to prepare a new circuit leading the next succeeding series of impulses to the corresponding order of numerical receiver. The longer vibratory period reed

comes to a position of rest immediately after the shorter reed and closes a shunt circuit through a releasing device, which places the separator in condition for further use. It is necessary to state here that the signaling impulses are so controlled by the signaling transmitter at each subscriber's station that each series of impulses is separated from the succeeding series by a time interval. It is during this short time interval, of about two-fifths of a second, that the separator reed comes to a position of rest and closes the switching circuit, preparing a new path for the next series of impulses immediately following

The numeralizer, Fig. 7, is a compound switch for giving electro-mechanical effect to the combined indication of the several numerical receivers constituting a percentage group. It is put into operation after each complete signalhas been registered. It combines the fractional circuits

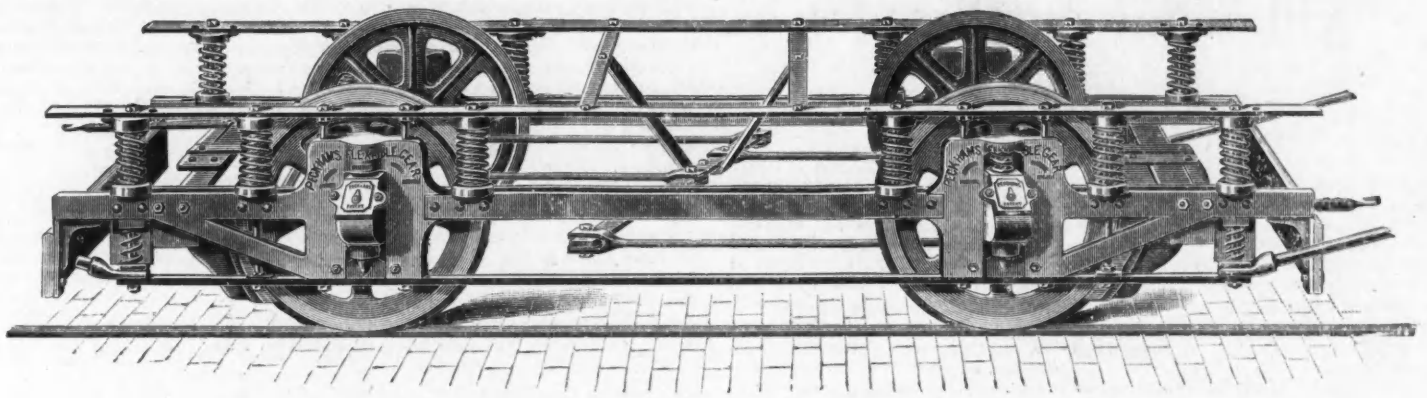


FIG. 1.—NEW PECKHAM TRAILER TRUCK.

controlled by the numerical receiver indications of hundreds, tens, etc., and selects an integral circuit equal in numerical value to the sum of the combined indications. It is based on the theory of decimal control, aided by a system of transforming circuits, and its method consists in causing one circuit to control tens, a hundred, a thousand, or ten thousand circuits, by eliminating decimally all values of the thousands, hundreds, tens orders, etc., not indicated by the compound registration of the numerical receivers.

The signaling track, Fig. 8, consists of an inclined runway having two copper rails insulated from each other. On one side the rail is continuous, and acts as a feeder for current supply. On the other side the rail is broken into sections having electrical connection with various parts of the percentage apparatus. The arrangement is such that when a circuit-closing ball is discharged over the track it runs along it and closes circuits between the rails and the apparatus electrically connected thereto. Each percentage division of the system includes one signaling track. As soon as a call is registered in any division of the signal receiving apparatus a circuit-closing ball is discharged along the signaling track of that division for the purpose of signaling to the calling subscriber a "busy" signal if the line required is in use. If connection has been established it is made known by a long continuous ring on the call-bells of the connected subscribers. At that part of the signal track where the circuit-closing ball is caused to ring the call-bells of the outlying stations, three disconnected sections of track are found.

The electro-mechanical connections to these track sections are such that when a calling subscriber has signaled for connection with a telephone already in use, the second section of track is made neutral so that the circuit-closing ball will ring the call-bell or bells on only the first and third sections of track; the second or neutral track being utilized for causing a time element between the call bell signals turned in by the passage of the ball over the first and third sections of track. On the other hand, if connection has been established, the three sections of track are conerted electrically into one long section, so that when the circuit-closing ball passes over the three sections of track a long continuous signal is caused to be sent over the lines of the two connected subscribers.

The connector is a counterpart of one portion of the circuit selector. It consists of a series of conducting strips pluralized on a percentage basis. By a process similar to the selection of the percentage connection for signaling purposes, the plungers of the calling and called subscriber are connected to one of the percentage strips, and left in that condition while communication is being held. The apparatus contributing to the final connection has all reverted to common use and the percentage connecting strip eventually becomes free for other users as soon as the conversation is terminated. Any of the connecting strips may be brought into operative relation with each of the subscriber's lines, the arrangement being such that when one is seized it is held by the signaling subscriber until he allows it to revert to common use by the transmission of a "release" impulse from his signaling transmitter.

The invention comprehends other features of novelty, such as the storing of calls for lines in use at the time of the call arriving, and an automatic recording system for registering the number of connections had by any subscriber.

The call storing system acts as follows: When a call is received for connection with some other telephone then in use that call is stored and a busy signal is sent over the line of the signaling telephone. The busy telephone is not interfered with until its user releases it from connection. As soon as this is done the stored call becomes effective, and a "connected" signal is sent over the lines of both parties to the new connection then made. Many calls may be stored for the same telephone.

A New Motor Truck.

We illustrate herewith a new truck now being placed on the market by the Peckham Motor Truck & Wheel Company, 26 Cortlandt street, New York, and designed by its president, Mr. Peckham, to meet the requirements of certain roads that favor a cheaper construction than its all-steel, machine-fitted trucks. The new "Excelsior" trucks are constructed upon the same general principle as Peckham's cantilever extension truck. The pedestal and spring supports are cast in one piece and secured by hot-driven rivets, no bolts being used in its construction. It is provided with a steel top frame connecting the different springs. It is so constructed that it can be used as a "trailer" truck, as shown in cut, Fig. 1, or as a motor truck with all the spiral springs, or as a motor truck with both spiral and end elliptic springs, as shown in Fig. 2. Its yokes are provided with Peckham's flexible gear, which supports the truck frame upon the journal boxes by graduated spiral springs; it is also provided with Peckham's dust-tight, self-lubricating journal boxes, and with truss extension for open cars, when so desired. Although somewhat lower in price than its all-steel, machine-fitted trucks, the new form is made with the same degree of care as to details, as is used in the construction of all Peckham trucks.

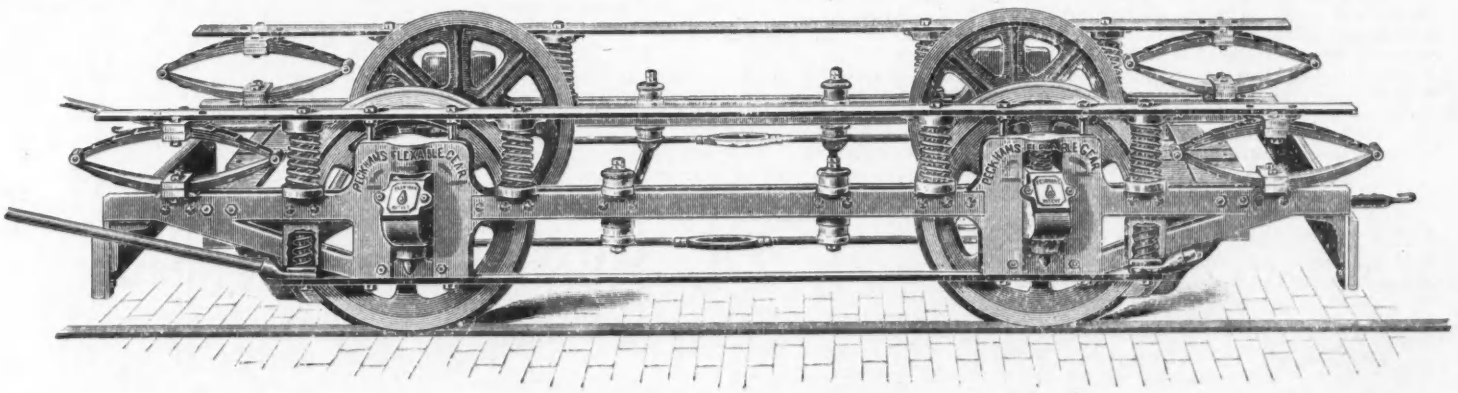


FIG. 2.—NEW PECKHAM TRUCK.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Jan. 5, 1895.

ELECTRICAL STOCKS continue to be handicapped by the sustained depression in stock market values. The financial horizon is streaked with gloomy hues, and the rays of coming brightness are as yet not strong enough to dispel the clouds of gloom. The complications of the currency question are again exercising a malignant influence on the nation's trade, and all branches of business are again feeling the evil results of distrust and lack of confidence.

GENERAL ELECTRIC'S quotations, accordingly do not show any life or buoyancy. There is no justification for the sagginess, all the cirumstances really warranting quotations continuing favorable. In fact were it not for a sympathetic reaction with the whole market depression, General Electric would rise as there is a distinctly bullish feeling on the security, a good many people formerly inimical to the property now manifesting a most friendly spirit towards it, but while the stock fails to respond to this change of sentiment, the bonds of the General Electric Company are acting very well. With the company's affairs nowadays in a comparatively comfortable and easy condition, these bonds are again becoming regarded as a good investment, and since the first of December they have advanced over 5 per cent., the coupon on that date having been a good deal more than recovered. And, when one looks into the recent record of the General Electric Company, it is no wonder that there should exist a demand of such proportions as has of late come to light. During the year the company purchased $1,000,000 of its bonds calling for an expenditure at an average price of 85 or $850,000. It also has $600,000 cash in bank arising out of profits from sales. This makes a surplus earned during the year of $1,450,000 above interest charges on the entire issue of debenture bonds, a sum equalling 7 per cent. on the preferred stock and nearly 4 per cent. on the common stock, a pretty good showing for a bad year. This has been made possible by the introduction of conservative methods in the matters of sales and collections. The $1,000,000 bonds in the company's hands were not retired, but are held in the treasury as an investment, the interest money being regularly put aside. The intention is to continue the present policy of retiring the bonds until such time as the reconstruction of its finances will allow the company to resume dividend payments on both classes of stock. Business continues good, the gross output of apparatus being above $1,000,000 per month.

WESTINGHOUSE ELECTRIC issues are quiet pending the complete removal of the company's works to the new Brinton plant. The Westinghouse people in this city decline to discuss the report that they are figuring on the cost of electrically equipping the Manhattan Elevated Railroad Company, of New York, although previous reports had it that the General Electric would get the contract. The Manhattan people will not say with whom they are treating in the matter, but both companies are understood to be eagerly bidding for the chance. There has been some unlooked for delay in the operation of removal to Brinton, but the officials say it is now progressing satisfactorily, though they cannot say when the whole Westinghouse plant will be housed in the new shops.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked
Chicago Edison Company	100	127	130
Cleveland General Electric	100	80	90
East River Electric Light Co.	100	—	50
Edison Electric Ill., New York	100	101	102
" " " Brooklyn	100	110	112
" " " Boston	100	120	124
" " " Philadelphia	100	120	125
Edison Ore Milling	100	13	15
Electric Storage Co., Philadelphia	100	35	40
Electric Construction & Supply Co., com.	15	7⅛	10
" " " " pref.	15	7⅛	10
Fort Wayne Electric	100	1⅞	2
General Electric	100	34	34⅛
General Electric, pref	100	67	70
Westinghouse Consolidated, com.	50	32⅛	33⅛
" " pref	50	50	50⅛

BONDS.

Edison Electric Ill., New York	1,000	108	109
Edison Electric Light of Europe	190	75	85
General Electric Co. deb. 5's	1 000	92⅛	92⅛

TELEGRAPH AND TELEPHONE.

American Bell Telephone	100	190	191
American District Telegraph	100	35	40
American Telegraph & Cable	100	91	92
Central & South American Telegraph	100	102	105
Commercial Cables	100	130	145
Erie Telephone	100	51½	52
Gold & Stock Telegraph	100	103	105
Mexican Telegraph	100	180	190
Mexican Telephone	100	75	80
New England Telephone	100	67	69
New York & New Jersey Telephone	100	97	98
Postal Telegraph-Cable	100	50	55
Western Union Telegraph	100	86⅞	87

FORT WAYNE CORPORATION issues are exciting interest anew. Mr. R. T. McDonald confirms the rumors published that the Wenstrom Electric Company will soon bring suits against the users of apparatus furnished by the leading electrical companies as infringers on Wenstrom patents. Mr. McDonald says a number of suits will be entered at once, the users of trolley apparatus furnished by other companies to be prosecuted first. The suits will be started on Wenstrom armature patent infringements, and they are expected to be filed within a week or two. The Wenstrom works now controlled by the Fort Wayne Corporation are reported to be running on full time and filling a good amount of orders.

STANDARD UNDERGROUND CABLE stock is still advancing, 94 being recently bid for 100, buyers 60. Insiders appear to be very bullish on this stock. The regular quarterly dividend of 1½ per cent. has been declared payable January 10. The company had, it is reported, an exceptionally good year in 1894, and prospects for even material improvement in 1895 are reported as being very bright.

AMERICAN BELL TELEPHONE stock is still in the dumps. Nothing new develops regarding the recent stock subscription fiasco, it is stated that only 1,500 shares of the 5,000 issue were taken.

EASTERN ELECTRIC CABLE preferred stock has received a semi-annual dividend of 3 per cent.

TRACTION STOCKS act sluggishly. The usual January investment demand is not cutting much of a figure this year, and street railway issues are not being helped along much by the January disbursements. A new traction security now offered to investors is an issue of $2,500,000 5 per cent, forty-year bonds, put out by the Second Avenue Traction Company, of Pittsburg. These bonds are for the purpose of improving and extending the company's system.

ELECTRIC TRACTION STOCKS.

	Bid.	Asked
Union Ry. Co. (Huckleberry)	115	120
Brooklyn Traction, pref	66	69½
" " com	14½	15⅞
Long Island Traction	14	14
Rochester St. Ry	30	40
Columbus St. Ry	45	50
Louisville St. Ry. pref	87	88
" " " com	37	39
Cleveland Electric Ry.	45	47
Cleveland City Ry.	68	70
North Shore Traction	23⅛	25
New Orleans Traction	63⅞	65
Worcester Traction pref.	80	82
" " com.	13	14
Metropolitan Traction, Philadelphia	103	104
Philadelphia Traction	98	100
People's Traction	51⅛	52
Binghamton R. R. common	100	—

BONDS.

	Bid	Asked
*Union Ry. 1st. mtge 6s	105	108
*Westchester Electric 1st. mtge. 5s	98	101
Rochester St. Ry. 1st. 5s	95	97
*Columbus St. Ry. 1st 5s	95	97
Columbus Crosstown 1st. 5s	95	97
*Binghamton Railroad Co. 5s	99	100

*With accrued interest.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, Jan. 5, 1895.

MESSRS. HOWARD C. WHITNEY, formerly with the Crocker & Wheeler Electric Company, New York, and Lewis O. Brewster, formerly manager of the New York office of Almond & Sargent, of Boston, have associated themselves with the sales department of the New York Insulated Wire Company. The office of business manager of the company has been abolished.

MR. JAS. F. KELLY, formerly manager of the United States and Wire Cable Company, of New York, has associated himself with the sales department of the New York Insulated Wire Company. Mr. Kelly is well known to the trade, among whom he has many friends, and is exceedingly popular, and we congratulate the New York Insulated Wire Company upon its acquisition of his services.

MR. JEFFERSON YOUNG has been appointed manager of the New York office, at 112 Liberty street, of the Stilwell-Bierce & Smith-Vaile Company, whose extensive factories are located at Dayton, O. Mr. Young will give his entire attention to pushing the sale in the New York market of its specialties in pumping and hydraulic machinery, feed-water heaters and purifiers, filter presses for all purposes, water columns, tank valves and jacks, and enters upon his responsible position with the determination of meriting and winning success.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, January 4, 1895.

TELEPHONE PEOPLE are much interested in the new wiring system for exchanges by the National Telephone Manufacturing Company, this city. It is claimed to be the most economical and simple, as well as the most desirable system placed upon the market. This company has been quietly selling telephones and switchboards for exchanges in different parts of the country. We have just learned of a shipment of nearly 200 instruments to the West to replace telephones of other makes. Some twenty or more of the beautiful desk sets made by this company are now used in the New York City Court buildings, to say nothing of the new palace hotel "Majestic" which alone is using 500 instruments. The new State House annex here, one of the most magnificent buildings in the country, has just been completed, and the National Company has installed in it a large plant connecting the President of the Senate, Speaker of the House, and also all the other principal officials. The War Department at Washington is now testing the "National" instrument, with a view to its adoption and use in all the various depots and posts throughout the country. We understand the "National" has been in use for some time at the Military Academy, West Point.

THE AMERICAN TOOL AND MACHINE COMPANY, of Boston, is now located in its new offices and works at 302 Federal street, that city, and it may be truthfully said that it is a fitting home for a deserving company—now for nearly fifty years before the public, the confidence of which it has enjoyed to an extensively liberal extent and still possesses. In the line of engineering and machinery work its reputation is of the highest order. In its new home, which practically embraces two buildings, it is surrounded by the best facilities for good and quick work, to say nothing of its large and well-equipped factory at Hyde Park, Mass. Mr. M. H. Barker, who has been identified with the company for twenty-three years, has been made its general manager, and Mr. M. M. Whipple, whose connection extends to over a period of sixteen years, has been elected as assistant general manager, positions both of these gentlemen are thoroughly competent to fill creditably to themselves and profitably for the company. Mr. W. O. Lincoln remains with the company as treasurer, a position he has held for upward of ten years.

THE BOSTON MOTOR COMPANY, 17 Batterymarch street, reports an excellent business, of course, during the holidays. The demand for its motor and battery outfit for toy purposes was naturally quite large, but its business generally, for some time, has been exceptionally good, particularly in the line of its larger motors, adapted especially for sewing machines, ventilating fans, dental drills, jewelers, lathes, etc., and, in fact, all kinds of light work. Its medical coil has also received its share of recognition. The *Youth's Companion* is one of its most liberal patrons. It has been awarded first prize by the Massachusetts Charitable Mechanics' Association, and the Harvard University uses several of its motors, and says of them that they work splendidly. It may be said that all the motor manufactures of this company are thoroughly efficient, to which may be added cheapness. Mr. John J. O'Lalor, proprietor of the company, is a deserving young man, and is winning his success entirely by personal effort and hard work. He understands thoroughly his business, and before branching out for himself did good and faithful work for other electrical corporations, being identified with the Sprague Motor Company and the Bernstein Electric Company.

THE PETTINGELL-ANDREWS COMPANY, of Boston, with the commencement of the year, has assigned their well-known and popular traveling representative, Mr. J. E. Wilson, who has been connected with the company for a number of years, always securing good success, to the territory embraced in the western part of New England, New York State and Eastern Pennsylvania. Mr. T. G. Smith, a young man of ability and energy, who started as a boy with the company, and latterly has had charge of its sales department, has been assigned to the territory formerly covered by Mr. Wilson—the western part of New England.

IN THE LINE OF CALENDARS for 1895, the electrical corporations and firms of Boston may refer with pride to their productions. Those thus far received at this office are the Pettingell-Andrews Company, W. S. Hill Electric Company, J. Bradford Sargent, Ziegler Electric Co., and the Anchor Electric Company. The Anchor calendar is really a beautiful and artistic production, the engravings being particularly handsome and attractive.

C. H. M'KENNEY & CO., of Boston, whose reputation in the manufacture of gas and electric fixtures is second to none, may congratulate themselves upon having such a capable representative as is Mr. Fred. G. Rogers. He is a "hustler," and if business is to be had he will get it.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
936 Monadnock Building, Chicago,
January 5, 1895.

THE SUNBEAM LAMP MANUFACTURING COMPANY, now that the oppressive yoke of litigation has been removed, is preparing to push ahead with vigor. Sunbeam lamps will soon be seen in every part of the country again, as they were not so long ago.

THE CENTRAL ELECTRIC COMPANY has taken inventory, and says that the figures would surprise people who have no adequate idea of the magnitude of the electrical supply business.

THE NUTTING ELECTRIC COMPANY has distributed its new printed matter, and is beginning to find that people have a genuine interest in the "Wax Wheel" arc lamp.

THE CHICAGO INSULATED WIRE COMPANY reports everything as highly satisfactory—a condition of things that but few firms can boast of these days. Its factory is unusually busy for this season of the year.

ERNEST WILLIAM COOKE, one of the ablest and best-known men in Western electrical circles, is on an Eastern trip. He is arranging for several important agencies.

THE AMERICAN ELECTRIC MANUFACTURING COMPANY, of St. Louis, reports an interesting fact in reference to the good-of-the order blanks it has been supplying of late. Every now and then it receives an order from some out-of-the-way place where it never had any idea the "American" lamp was known.

THE DEARBORN ELECTRIC COMPANY seems to have made a good start, if indications count for anything. Its store is one of the busy places of town.

THE WASHINGTON ELECTRIC COMPANY is busy with annunciator and other work, and has no reason for fearing a lack of business in 1895.

THE METROPOLITAN ELECTRIC COMPANY says its orders for the Allen soldering stick are something immense. In nearly every other department it is particularly busy.

General News.

NEW INCORPORATIONS.

THE ROCK HILL TELEPHONE COMPANY, Rock Hill, S. C., capital stock $5,000, has been organized by J. G. Anderson and A. E. Smith.

THE DETROIT RAILWAY, Detroit, Mich., capital stock $1,000,000, has been incorporated by Green Pack, Albert Pack, Chas. L. Pack, Henry A. Everett and Chas. W. Wason.

THE NATCHEZ ELECTRIC RAILWAY COMPANY, Natchez, Miss., capital stock $100,000, has been incorporated. The promoters are R. F. Leonard, W. A. S. Wheeler and J. A. Clinton.

THE CORSICANA MUTUAL TELEPHONE COMPANY, Corsicana, Tex., capital stock $10,000, has been incorporated by James Garrity, A. N. Drane, S. A. Pace, C. E. Jester and James L Autry.

THE POTTS MACHINERY SUPPLY COMPANY, Columbus, O., capital stock $10,000, has been formed by Wm. B. Potts, Walter B. Page, I. N. Hansbrough, Chas. I. Scheaf and Isaac B. Potts, to manufacture electric specialties, etc.

THE CHARLES F. BURNS COMPANY, Rochester, N. Y., capital stock $5,000, has been formed to manufacture and sell all manner of supplies for electrical railways. C. F. Burns, E. M. Higgins, Alfred Creen, Rochester, are the promoters.

THE EMPIRE LIGHT AND POWER COMPANY, Quincy, Ill., capital stock, $25,000, has been incorporated to generate electricity for light, heat and power. Isaac L. Faucett, Harry O. Channon and John P. Wheeler, are the organizers.

THE BOSTON SWITCH MANUFACTURING COMPANY, Portland, Me., capital stock $1,000, has been formed to manufacture and deal in electrical apparatus. Wm. L. Haven, Robert W. Frost, Boston; and Chas. H. Clark are the interested persons.

THE COLUMBUS ILLUMINATING COMPANY, Columbus, O., capital stock $25,000, has been formed to establish and operate eletric light, heat and power plants. R. J. M. Danley, Columbus, O.; W. D. Park and W. A. Hardesty are the interested parties.

THE ACME ELECTRIC COMPANY, East Palestine, O., capital stock $10,000, has been incorporated by Geo. E. Sebring, R. N. Chamberkin, D. H. Mackintosh, Chas. Beyer and R. S. Chamberkin, to erect and maintain an electric light and heat plant.

THE ANTHONY COMPANY, Cincinnati, O., capital stock $200,000, has been formed to make and deal in electrical and magnetic appliances, and to construct and operate telephone lines, etc. The promoters are Mark O. Anthony, Louis Feder and Max Silberberg.

THE KINGS COUNTY ELECTRIC LIGHT AND POWER COMPANY, Jersey City, N. J., capital stock $1,000,000, has been incorporated by Edwin Lowe, of Brooklyn, and others to do a general business in generating electricity for light, heat and power.

THE FARQUHAR ELECTRIC COMPANY, Suffolk, Mass., maximum capital stock $1,000,000, has been formed to manufacture and lease electrical machinery and appliances, etc. Donald H. Farquhar, Chas. H. Whitcomb, and Frank L. Whitcomb, Boston, Mass., are interested.

THE NEW MARTINSVILLE AND MANNINGTON TELEPHONE COMPANY New Martinsville, W. Va., capital stock $20,000, has been formed. The promoters are W. S. Barrack, Burton; John E. Poe and A. M. Crow, of Littleton, and Amos Jolliffe, of Uniontown, W. Va.

THE CALIFORNIA ELECTRIC LIGHT AND POWER COMPANY, California, Mo., capital stock $6,000, has been incorporated to build and operate an electric light and power plant. The organizers are E. B. Crane, W. H. Mengel, Henry Herfurth and J. P. Gray.

THE W. J. DAVIS ELECTRIC COMPANY, Pittsfield, Mass., capital stock $6,000, has been formed to manufacture electrical apparatus, electric and gas fixtures, and other mechanical apparatus. Jacob Crinlich, Wm. P. Wood, W. J. Davis and John White are the incorporators.

THE BUFFALO ELECTRICAL TRANSIT COMPANY, Buffalo, N. Y., has been incorporated to construct and maintain an electric telegraph and telephone company. T. B. McMahon, Charles Oishei, W. W. Read, and T. C. Brown, Buffalo, N. Y., are the interested parties.

THE NASHOLD CLEAT COMPANY, Chicago, Ill., capital stock $10,000, has been formed to manufacture and sell electrical appliances and supplies, and to buy and sell goods and patents relating thereto. Elias Nashold, M. W. Cresey and Luther E. Ellison are the interested parties.

THE PARKESBURG ELECTRIC LIGHT, HEAT AND POWER COMPANY, Parkesburg, Pa., capital stock $10,000, has been formed to generate and supply electricity for light, heat and power. Horace A Beale, Thos. C. Young and Enoch P. Moore, Parkersburg, Pa., are the promoters.

THE LOOP CONSTRUCTION COMPANY, Chicago, Ill., capital stock $1,000,000, has been incorporated to build and construct elevated and electric rail-

roads, and to furnish materials and appliances for same. Douglas Hotchkiss, Geo. E. Newlin, and Wm. M. Johnson are the promoters.

THE BUCKEYE GAS COMPANY, Circleville, O., capital stock $300,000, has been incorporated by J. B. Bradley and others for the purpose of building and operating electric light and electric street railways, manufacturing electrical supplies; also drilling for, producing and piping natural gas and petroleum.

THE CARTERVILLE LIGHT AND POWER COMPANY, Carterville, Ga., maximum capital stock $100,000, has been formed to generate and supply electric light and power; illuminating or fuel gas, etc. Peter W. French, Weymouth, Mass.; T. Putnam Symonds, Salem, Mass., and Wm. E. Merill, Haverhill, Mass.

THE TRENTON TRACTION COMPANY, Trenton, N. J., capital stock $500,000, has been incorporated to buy, acquire, lease and operate street or surface railways. E. J Moore, Philadelphia, Pa.; Thos. C. Barr, East Orange, N. J., Francis M. Eppley, West Orange, N. J., and George B. Jenkinson, Newark, N. J., are the promoters.

Telegraph and Telephone.

KNOXVILLE, TENN.—The People's Telephone Company started business on January 1 with a large list of subscribers, leaving the old Bell Company but 38.

DANVILLE, KY.—L. Eddy will establish a telephone exchange.

ORANGEBURG, S. C.—The Southern Bell Telephone Company, of Atlanta, Ga., will establish a telephone exchange in Orangeburg.

READING, PA.—Mayor Shanaman has signed the resolution passed by councils providing for the appointment of a committee of five to confer with the Pennsylvania Telephone Company officials, and urge them to take steps to place their wires underground. Should the matter be favorably regarded, it is proposed to ask other companies to place their wires underground before street paving is begun on an extensive scale.

PRESTON HOLLOW, N.Y.—A company has been formed to put into operation a telephone line from Middleburg to Oak Hill. The officers elected are as follows: President, E. Dutton; secretary, Dr. E. S. Shaffer; treasurer, W. P. Elsbree; directors, W. E. Nassler, Middleburg; W. Case, Livingstonville, and others. Application for a charter will be made at once, and it is expected that the line will be in full operation by April 1.

Electric Light and Power.

CAMBRIDGE, ILL.—Hillman & Co., of Peoria, who were granted a franchise for putting in an electric light plant for the village, commenced to break ground for the power house, which will be a brick structure 40x40 feet and 13 feet high. They will use a Ball dynamo for the street lights and a Royal dynamo of their own manufacture for incandescent lights. Their engine will be 100-hp.

STOUGHTON, MASS.—At a special town meeting in Stoughton to consider the matter of the rebuilding and widening of Park street, a proposition was received from the Brockton and Stoughton Electric Railway Company offering to share the expense of doing the work, so as to enable the railway company to at once build the new Stoughton extension. This will undoubtedly result in the early laying of rails to connect Stoughton and Brockton.

BALTIMORE, MD.—The scheme to use the Susquehanna River as a means of generating electric power has taken a definite shape. A certificate of the Susquehanna River Electric Company has been filed for record, the incorporators being Moses H. Houseman, George K. McGaw and Winfield J. Taylor, of Baltimore, and Charles R. McConkey of Beach Bottom. The capital is $100,000. It is proposed to dam the river near Conowingo, Md., and to erect a large electric power house, similar to that in operation at Niagara Falls.

PEORIA, ILL.—In pursuance to the provisions of a resolution adopted by the City Council of the city of Peoria, Ill., at its regular meeting, held Dec. 18, 1894, propositions are solicited for the establishment of plants and the furnishing of the city of Peoria, Ill., and its inhabitants, with gas and electric light for light and fuel purposes, for a period of 10 or 20 years. All propositions must be received at Peoria, Ill., on or before Feb. 1, 1895. Address all communications and propositions to John H. Hall, Chairman of the Committee on Lights and Lamps of the City Council.

ATHENS, GA.—Athens has near at hand an immense water power that can be utilized at small expense, and a movement is on foot to make use of it at once. Mr. Rice, an electrical expert from Dayton, O., came to Athens a few days ago and had a consultation with a number of citizens of Athens in regard to this subject. The result is that the citizens have resolved to use the water power off Tallesee shoals, eight miles from Athens, for the purpose of generating sufficient electric power to run the street car line and any other manufacturing interests that may desire to purchase this power.

DES MOINES, IA.—Sealed proposals will be received by the Board of Public Works until January 10 for lighting the streets, alleys and public grounds for the term of two years from and after March, 1895. Bids will be received for 225 arc lights, or a greater number as may be ordered by the Board of Public Works.

BARTOW, FLA.—A local paper says that it is understood that some gentlemen are about perfecting arrangements to put in an electric light plant in Arcadia, which brings to mind again the fact that Bartow needs lighting, and it would make a good investment for one who wishes to install a plant. There can be no reasonable doubt, it says, but that an electric light company can make good money from the start.

The Electric Railway.

AUGUSTA, ME.—Augusta people are pleased with the scheme for an electric railroad to Waterville, and argue that it would pay and boom the business of both cities.

SIDNEY, O.—An electric railway of considerable proportions is just now interesting the people of this city. Articles of incorporation in the sum of 100,000 have been taken out, and stock is being rapidly subscribed. The road is to be 20 miles in length, traversing the entire western part of the county, taking in the towns of Hardin, Wynert, Loremies, terminating at Minster, in Auglaize county.

PHILADELPHIA, PA.—The now famous Suburban Trolley bill, which grants to the Philadelphia Traction Company the exclusive use of over 100 miles of streets in the upper section of the city, nearly all of which exist at present only on paper, was boldly pushed to a final vote and passed in the Common Council. The bill was passed by the upper branch on December 6, and it now goes to the Mayor for his signature or veto.

HAMILTON, O.—The Cincinnati, Hamilton, Middletown & Dayton Railway Company is the name of a new corporation authorized by the Secretary of State. The company is organized for the purpose of building an electric line between Cincinnati and Dayton. The incorporators are Messrs. Hickenlopper, Chas. Fleischmann, H. H. Hoffman, H. B. Morehead, O. B. Brown and L. C. Weir. They have a capital stock of $500,000.

NEW HAVEN, CONN.—An unknown company has made application to use the streets of the city for the purposes of an electric railway. It is a sort of blanket petition, and covers pretty much of the whole of New Haven and a good part of the outlying districts. Jacob E. Emery, lawyer, with an office in Room 16, Exchange Building, can probably give further information. He was treasurer of the old State Street Horse Railroad.

ATLANTA, GA.—Atlanta is to have a summer resort next season. The Hale Investment Company has purchased land and will transform it into a pleasure resort. The new electric railroad to the grounds will be known as the Atlanta Electric Railway, and will run from a central point of the city. Mr. Dayton Hale has arrangements in charge. The improvements and the electrical road will be completed in time for the coming season.

ATLANTA, GA.—The Atlanta Consolidated Street Railway Company and another strong company now forming, will extend electric traction here. In addition to the new line, which has a strong backing, and which will furnish a magnificent service, the service of the Consolidated will be greatly improved upon by the building of power houses, new arrangement of terminal facilities, the purchase of new cars, and so forth, the improvements to cost about $100,000. Mr. Joel Hurt is president of the Consolidated Company.

BALTIMORE, MD.—The Baltimore and Lehigh Railroad (the old Maryland Central) proposes to substitute electricity for steam on its line, which is now being extended to York, Pa. President Houseman, of the newly chartered Susquehanna Electrical Company, which proposes to develop the power of the Susquehanna River at Conowingo Falls, is prominently connected with the Baltimore and Lehigh Railroad Company, as are also Winfield J. Taylor and J. Summerfield Bull, directors in the Susquehanna Company. This railroad alone would require a current representing several thousand horse-power. Its route is only seven miles from the proposed site of the dam.

Personal Notes.

THE NEW FIRM of the Ferris Electrical and Manufacturing Company has been organized, with its headquarters established at Cedar Rapids, Ia., to take care of the local construction and electrical interests of that enterprising city. The firm will be composed of Mr. Thomas Ferris, formerly connected with the engineering department of the General Electric Company, being one of the original "Edison men" for years, and at present traveling for the General Electric Company in the West, and Mr. Robert Ferris, for seven years a practical electrical worker, and who has held important positions with the Ansonia Electric Company, the General Electric Company, and up to within a recent date has been one of the most successful traveling men in the employ of the

ROBERT FERRIS.

THOMAS FERRIS.

Central Electric Company, which boasts of the best corps on the road. In the long ago days he was in the railway department of the Thomson-Houston Electric Company, at Lynn. It is the intention of the firm to carry on a general construction business, handle supplies of all kinds, making a specialty of fixtures. They will also manufacture a line of specialties, such as designs for window displays, and other novelties that are from time to time demanded. They will also have a repair department of considerable proportions. Altogether they will be in a position to install electrical plants complete, both railway and lighting, and supply everything necessary for the running of the same. The members of the firm are young men of high standing in electrical circles and their plan of organization is such as to merit the patronage of every one in search of excellent work.

Trade and Industrial Notes.

J. SCHAWEL & CO., 29 John street, New York, importers and melters of platinum, send us a card containing some useful information relating to platinum. The Troy weight of platinum wire and sheet foil per foot and square inch respectively are given for sizes of wire from No. 6 to No. 4 B. & S. Gauge and thicknesses of foil from .162 to .003 inch.

THE WHITNEY ELECTRICAL INSTRUMENT COMPANY'S Canadian works at Sherbrooke, Canada, were badly damaged by fire on Saturday night, December 29, at 12 o'clock. The damage on the plant and stock is $10,000, on which the insurance is $5,000. The company intends to rebuild at once, and in the meantime Canadian orders are promptly attended to at its Penacook, N. H., factory.

THE BERLIN IRON BRIDGE COMPANY, East Berlin, Conn., is building a new power house for the Sing Sing Electric Light Company, at Sing Sing, N. Y. The building is 550 ft. wide and 100 ft. long, the roof being covered with anti-condensation corrugated iron. The New England Pin Co., at Winsted Conn., have placed a contract for the bridge connecting the two departments of heir works with the same company.

DIETERICHS, WARWICK & COMPANY, Cleveland, O., have succeeded to the business of P. B. Warwick, who remains with the new concern. Mr. Warwick was for several years with the late Ford-Washburn Storage Battery Company, and is now electrician of the P. W. Storage Battery Company. The new company has been formed to put on the market the latest types of slow-speed dynamos and motors, the invention of Mr. Warwick. The winding of the armatures of these machines is done by machinery, and each coil is capable of being removed without disturbing the remaining ones, thus curtailing a large reduction in first cost and repairs.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., in a recent announcement states that phosphor-copper and phosphor-bronzes are being more and more extensively used. The peculiar change which copper and bronzes undergo when fluxed with phosphorous is not well understood, but the effects are fully appreciated, strength and toughness are increased, and liability to corosion decreased. For these reasons phosphor-bronzes are being used very largely in marine and railway construction. The charging of the phosphorous into the molten metal must be done with considerable system and care. This part of the operation may be safely and easily accomplished by the aid of phosphorous chargers or phosphorizers made of plumbago. The Jos. Dixon Crucible Company, which makes plumbago goods in great variety for metallurgical purposes, also makes these phosphorizers in different sizes, suited to the size of the crucible in which the fluxing is to take place.

THE MATHER ELECTRIC COMPANY, of Manchester, Conn., reports a very bright outlook for the year of 1895, and, in fact, has at no time during its existence had so many orders on its books as it has to-day. The company now have in course of construction in their works at Manchester the following apparatus on orders: five 200-kw, twelve 100-kw, one 80-kw, eight 60-kw, three 45-kw, three 30-kw, belted generators of its new multi-polar type; also three 100-kw, one 80-kw, two 65-kw, two 50-kw, and one 30-kw, direct connected generators of its new multi-polar type; and, also, thirty-one ring type dynamos and seventy Manchester motors of various sizes. Notwithstanding the extensive additions in the way of new tools and facilities recently made to its Manchester plant, the company has found it necessary for the last two months to operate its entire plant twenty-four hours a day, with two shifts of men, but so far have been unable to keep up with its orders. The first three days of January the Mather Company closed contracts for ten generators aggregating 300 kilowats, for railway and power work.

THE ELLIOTT TELEPHONE COMPANY, manufacturers of the Elliott telephone, has removed from Atlanta, Ga., to Nos. 27 and 29 West Morgan street, Martinsville, Ind., where it has superior facilities for handling its rapidly growing business with promptness and dispatch. Having moved from Martinsville to Atlanta one year ago, the company is now acquainted with the advantages and disadvantages of both the North and the South, and finds that the cost of manufacturing its apparatus is reduced to a minimum, at its present location, which, with the low rates, superior shipping facilities, and the fact that it is near the center of population, enables a superior instrument to be offered for less money than ever before. The "Elliott," as well as the magneto telephones of this company, have made for themselves a reputation to be justly proud of, as a choice collection of unsolicited testimonials to their credit, from physicians, merchants, manufacturers and business men attests. The number of instruments sold in 1893 was more than four times those of 1892, and the sales for the nine months ending September 30, 1894, more than trebled those of 1893.

MR. ROMAINE CALLENDER will give, on and after January 23, an exhibition at the Decker building, New York, of the Callender Telephone Exchange system. Several years have been spent by the inventor in perfecting his system, in which he dispenses entirely with operators, and discards the expensive switchboard with its numerous connections. Subscribers make their own connections automatically by the use of a simple device attached to each telephone. Its use obviates extra wires and multiple connections, and does not require an individual apparatus at the exchange for each subscriber. By a simple arrangement the connecting mechanism at the exchange is common to all of the subscribers, and ninety per cent. of the installation expense is saved by providing only sufficient apparatus to meet the maximum demands of the subscribers at one time, it being a well-known fact that only a percentage of the total number of telephones is ever in use simultaneously. The new system provides means for registering the number of connections had by each subscriber, so that, where desired, payment for actual use may be arranged for on an equitable basis. It takes only twelve seconds to establish a connection, no matter how high the number called. These improvements, it is claimed, make the construction so much less expensive than existing systems, that telephones can be supplied to subscribers at from thirty to sixty per cent. less than present rates; the exact saving depending upon local conditions.

THE PECKHAM MOTOR TRUCK & WHEEL COMPANY, New York, reports that its business in 1894 showed a decided increase over the preceding year. The company found no difficulty in running its works at full capacity during the entire year, showing the increased demand for Peckham's trucks as they become better known by street railway companies. More than 2,000 of the Peckham trucks are now in use on the cable and electric roads in New York City, Brooklyn, Jersey City, Hoboken and Philadelphia, where they have been adopted as standard, after a thorough trial. Among these ten roads on which the Peckham trucks have been adopted as standard, may be mentioned the Atlantic avenue road in Brooklyn, the Consolidated Traction Company's lines in Jersey City, the People's Traction lines in Philadelphia, and the Metropolitan Street Railway Company's lines in New York City. The Peckham Company has brought out during the year their new "Excelsior" trucks, including the "Trailer" truck, designed especially for "trailer" cars; the "Spiral Spring" extension truck, designed for 16 ft. closed or 26 ft. open cars; the "Elliptic Spring" extension truck, designed for the same size cars as the "Spiral Spring" truck, and also their No. 10 "Swivel" truck for long cars. The chief feature of the company's work during the past year, however, has been the care given to the small details of construction. Many improvements have been made where the varying requirements of street railway service indicated that changes or improvements were desirable. The main design of the Peckham truck has not been changed, as this has been found to be entirely satisfactory. During the year 1895 other new features will be added where they may be found to be desirable, and judging from the present prospects, the Peckham truck will be adopted during the year by a large number of electric railways as their standard.

Business Notices.

WOVEN WIRE BRUSHES.—The Belknap Motor Company, of Portland, Me., are the patentees and manufacturers of the best woven wire commutator brush on the market.

BATTERY CUT-OUT, CHEAP.—Sensitive, reliable, never requires attention Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren street, Syracuse, N. Y.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JANUARY 1, 1895.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

531,650. TELEPHONE INDICATING APPARATUS; J. I. Sabin and W. Hampton, San Francisco, Cal. Application filed January 25, 1894. The combination with a self restoring visual indicator, of a non-restoring indicator, and means for actuating the non-restoring indicator when the self-restoring indicator is actuated.

531,651. ELECTRIC BLOCK SIGNAL; C. H. Salada, Pittsburg, Pa. Application filed April 9, 1894. This consists of an apparatus arranged along the line of track capable of sounding an alarm in the locomotive cab.

531,657. TRANSMUTER FOR ELECTRICAL CURRENTS; W. J. Still, Toronto, Canada. Application filed April 5, 1893. This consists of securing on a shaft a cylinder of insulating material around which is secured metal rings with lateral toothed projections which are arranged to coact with a series of brushes, the cylinder being rotated by a motor arranged in a fixed relation to the transmuting cylinder.

531,663. BASE FOR INCANDESCENT ELECTRIC LAMPS; G.C. Thomas, South Framingham, Mass. Application filed November 28, 1893. This consists of a vitreous disk having its edge of varying thickness.

531,677 PRINTING TELEGRAPH; S. V. Essick, Yonkers, N. Y. Application filed April 20, 1892. This comprises a type wheel, feeding carriage, and train of gear, in combination with mechanism for releasing the carriage at any time, and means for returning the carriage to its starting position when released.

531,698. ELECTRIC ARC LAMP; C. A. Pfluger, Chicago, Ill. Application filed April 5, 1894. This comprises a pivoted lever controlled by the series coil, a second pivoted lever controlled by the shunt coil, an elastic connection between the two levers, a clutch associated with one of the carbons of the lamp and connected to the lever controlled by the shunt coil, whereby the clutch is moved only by the movement of the shunt coil lever.

531,702. CLEAT FOR ELECTRIC WIRING; J. H. Swift and W. F. Maintien, Plainville, Mass. Application filed March 17, 1894. A cleat having the meeting faces of its parts non-level and having transverse wire holding notches, the notches being rounded.

531,707. BRUSH FOR DYNAMO ELECTRIC MACHINES; J. B. Wallace, Ansonia, Conn. Application filed April 30, 1894. This consists of a body of conducting material and a surrounding covering of gauze or cloth of high resistance material.

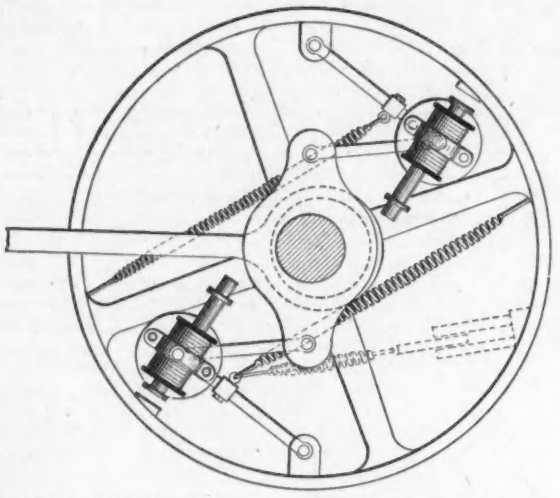
531,708. ELECTRIC SIGNAL; W. J. Wessenberg and H. J. Wilbur, Meriden, Conn. Application filed August 12, 1893. This comprises two stationary lenses and a swinging diaphragm having a smaller and an elongated opening, and mechanism for operating the diaphragm.

531,751. ELECTRIC ARC LAMP; A. Schweitzer, Allegheny, Pa. Application filed June 22, 1894. This comprises a pair of curved carbon holding tubes suspended in a support provided with set screws, whereby the carbons can be adjusted laterally in relation to each other.

531,761. CUT-OUT BOX; G. H. Alton, Lynn, Mass. Application filed February 7, 1890. The combination with a base having a binding block provided with a turn button, of a lid having an electrode provided with an extension.

531,764. ELECTRIC CAR LIGHTING APPARATUS; W. Biddle, Brooklyn, N.Y. Application filed May 8, 1894. The combination with a dynamo adapted to be run at varying speeds and having reverse wound helices and a secondary battery and working circuit, of circuit connections and a polarized compound switch having contacts in a circuit through one of the field helices of the dynamo when the electromotive force of the armature falls below that of the secondary battery.

531,765. CIRCUIT REGULATING DEVICE IN ELECTRIC CAR LIGHTING APPARATUS; W. Biddle, Brooklyn, N. Y. Appliccation filed May 28, 1894 The combiation with the secondary battery and its working circuit and a dynamo driven at different speeds, of a three point switch in the circuit between the dynamo and the battery, electro-magnets for moving the same and changing the circuits automatically, and springs for automatically breaking the circuit when the electromotive force sinks as low as the battery.



No. 531,849.—Electric Steam Engine Indicator.

531,790. METHOD OF OPERATING OR CONTROLLING ELECTRIC MOTORS OR DYNAMOS; R. Eickemeyer, Yonkers, N. Y. Application filed November 2, 1891. This comprises an armature, a mass of iron affording pole cheeks appropriately located with reference to the armature, and a rotative field magnet, located within the mass of iron, and provided with a core which, when axially varied in position, will variably switch the magnet flow, and cause it to pass from either pole cheel to the other, for driving the motor in either direction.

531,821. CONSTANT CURRENT DYNAMO; J. J. Wood, Fort Wayne, Ind. Application filed July 3,1894. This comprises a pedestal constructed with opposite hand poles combined with hand hole covers for closing the holes, and means for fastening them to the pedestal.

531,837. TROLLEY; T. Cooper, Providence, R. I. Application filed September 7, 1894. This comprises circular side plates, an annular contact to prevent the independent rotation thereof.

531,840. ADJUSTING MECHANISM FOR ARC LIGHT CARBONS, and means adopted to interlock with portion of the contact; E. F. G. H. Faure, Schenectady, N. Y. Application filed August 22, 1894. This consists of clamping jaws support upon a center, means for holding the jaws together, or releasing them, and means for turning them about their center.

531,849. ELECTRIC STEAM ENGINE GOVERNOR; C. B. Melott, Rondout, N. Y. Application filed July 21, 1894. The combination of a steam engine, fly wheel and a valve adjusting mechanism, the said mechanism being moved by magnetic attraction.

531,854. TELEGRAPHIC TRANSMITTER. J. J.O'M. Neil, New York, N. Y. Application filed February 28, 1894. This comprises keys and contact points, a sliding carriage, a track for the carriage, a motor for moving the carriage in one direction and a spring for moving it in another direction, means for locking and releasing the motor, and means for controlling the return movement of the carriage.

531,866. METHOD OF AND MEANS FOR MEASURING ENERGY OF ALTERNATING ELECTRIC CURRENTS; O. B. Shallenberger, Rochester, Pa. Application filed September 19, 1894. This comprises a supporting frame horizontal arm and coils, and an adjuatible support for the coils carried upon the arm.

531,867. METHOD OF AND MEANS FOR MEASURING ALTERNATING ELECTRIC CURRENTS; O. B.Shallenberger, Rochester, Pa. Application filed September 19, 1894. A current controlling device made to automatically vary the current in one of the actuating circuits in inverse proportion to the periodicity.

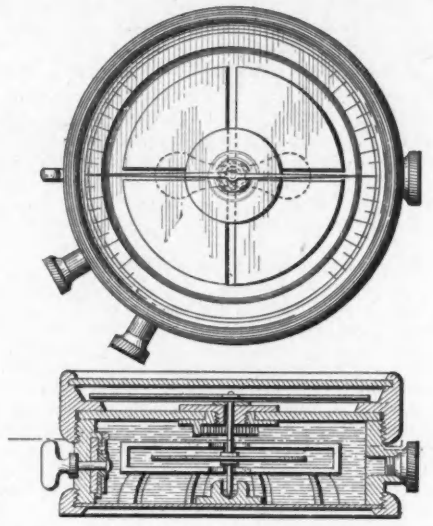
531,868. INDICATING WATT METER FOR ALTERNATING ELECTRIC CURRENTS; O. B. Shallenberger, Rochester, Pa. Application filed September 19, 1894. The combnation of a moving scale and damping device mechanically connected therewith to uphold the oscillation of the scale.

531,869. WATT METER FOR MULTIPHASE ALTERNATING ELECTRIC CURRENTS; O. B.Shallenberger, Rochester, Pa. Applcaton filed September 19, 1894. This comprises an actuating device responding to the currents transmitted over two or more circuits consisting of an armature and two independently operating sets of actuating coils, each set comprising a series coil connected in one circuit and a shunt coil connected across another circuit.

531,870. ALTERNATING CURRENT MEASURING INSTRUMENT; O. B. Shallenberger, Rochester, Pa. Application filed November 24, 1894. This comprises an armature, an actuating circuit and actuating coil and an inductance coil, a second actuating circuit includng an actuating coil and a non-inductive resistance, the actuating circuits being connected in parallel.

531,913. TELEPHONE SWITCH; A. G.Davis, Baltimore, Md. Application filed November 23, 1893. The combination with the main line of a telephone circuit and the electrogenerator and the bell operating magnet, of the horizontal longitudinally movable shaft carrying the main driving gear wheel, the contact points against which the wheel may be brought to bear, and connections whereby the generator and magnet are placed in the main line.

531,919. ELECTRIC RAILWAY SYSTEM; J. Frank, New York, N. Y. Application filed November 27, 1893. This comprises magnets connected on one side to a common rail and on the other side in divided circuits to rail sections in front and rear of the magnets, and a vehicle carrying a signal controlling armature and in turn adapted to close the circuit of the magnets.



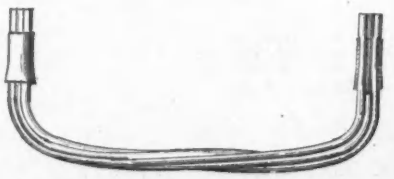
No. 531,970.—Electrostatic Voltmeter.

531,962. DISTRIBUTION OF ELECTRICITY; T. Parker, J. H. Woodward and S. G. Rees, Wolverhampton, England. Application filed February 24, 1892. This comprises high tension mains and distributing mains with transformers between the high tension mains and distributing mains, a switch station or station pilot or volt meter wires from the distributing mains to the switch stations, and switches controlled through the pilot wires to cut the transformer in and out.

531,970. ELECTROSTATIC VOLTMETER; H. A. Rowland, Baltimore, Md. Application filed February 24, 1894. A meter having a hollow movable needle immersed in a non-conducting liquid, of high specific inductive capacity.

531,978. ELECTRIC ARC LAMP; C. E. Scribner, Chicago, Ill. Application filed May 7, 1891. This consists of a vertically movable clutch by which the upper carbon is carried, and intervening mechanism controlled by the regulating mechanism, for feeding the carbon downward.

531,980. ELECTRIC RAIL BOND; G. E. Somers, Bridgeport, Conn. Application filed May 7, 1894. This consists of a series of strands of wire laid together and given a half turn so that strands of equal length may be used, the strands being retained in place by tapering ferrules, the upper ends of which are pressed into the strands and which are adapted to engage the rails in setting the bond in place.



No. 531,980.—Electric Rail Bond.

531,986. RAILWAY SIGNAL; D. H. Wilson, Chicago, Ill. Application filed February 10, 1894. This comprises an electric fence, a system of signals, a combined motor and generator having three armatures on one shaft and connections whereby the two generator armatures supply current for the fence and system of signals.

531,996. ELECTRIC CONVERTER; R. H. Hassler, Pittsburg, Pa. Application filed April 30, 1894. This comprises a core and separately wound and insulated coils thereon, the coils having projecting ends which are spread or arranged fan-wise.

532,003. ELECTRIC SIGNALING APPARATUS; G. E. Miller, Saugus, Mass. Application filed January 24, 1894. Means for automatically signaling between trains on the same track when within any predetermined distance as may be desired according to the length of the trains.

532,009. ELECTRIC SEMAPHORE SETTING DEVICE; H. A. Parrish, Jackson, Mich. Application filed February 10, 1894. This consists in arranging the parts so that the closing of the signal circuit moves the signal from an almost perfect condition of balance to a slightly unbalanced position, sufficient to restore the signal by gravitation as soon as the circuit is opened.